THE

ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

1905 Edition

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THE COST OF PRODUCTION

THE presidential address delivered by Mr. Alexander Siemens before the Institution of Electrical Engineers last week was of a somewhat unusual character, and has been criticised with undue severity. The position of the new President under the revised system of election is rather peculiar, seeing that the holder of that office is appointed six months before he assumes the reins of government. It is not easy to see why the alteration should have been made permanent, as we trust it may be many years before the calamity which led to its adoption recurs, but the wisdom of the course followed in the present instance, and of the choice of past-President to re-occupy the chair, is beyond dispute.

The President dealt chiefly with the question of lowering the cost of production, which he regarded as a measure of the progress of civilisation. The three principal factors concerned in the working of any industry, are the capital invested, the workman, and the management, and their interests are so closely linked together as to be identical. Each of these was considered in detail, though discussion of the tariff problem was rigorously excluded, so that the treatment of the subject necessarily lacks completeness. The President pointed out the risk of buying patents for inventions, which, at the present high rate of progress and change, may become worthless at any moment; the royalty system is more equitable and safe. Would that this system could be enforced in the case of all limited companies formed to exploit untried inventions; we should not then so often see an inventor enriched at the expense of the trusting purchasers, who are unable either to make the invention work successfully or to recover a farthing of the purchase money.

Mr. Siemens speaks clearly on the question of the workman's rights and duties. The reduction of the time spent on the production of any article is the workman's share in lowering the cost, and the use of labour-saving machinery is the most important means by which this can be effected; the workman, however, fails to realise that the introduction of such machinery is as much in his own interests as in those of his employer, the alternative to machine work being no work at all. The restriction of output often advocated and practised by workmen comes in for strong condemnation, and the outcome of the trade union theory that all workmen are of equal merit, and must be treated as such, is aptly illustrated by the decay of the glass bottle trade in Yorkshire, where the President started the first continuously working tank glass furnace 25 years ago; the Union opposed the new system, with the result that the trade is now practically extinct in this country. Yet nowadays the glass workers complain that foreign bottles are dumped here!

Touching on the features of good management, the President pointed out that many college graduates on their entrance into works fail to realise that their attention should

be directed primarily to studying the difficulties met with in manufacturing operations, and the modes of overcoming them, rather than to the acquisition of manual skill in workmanship. The old idea that a pupil should spend seven years in the workshops, learn to file a true plane, cut accurate screw-threads in the lathe, &c., has long been exploded; one does not require to do these things, but to know how to do them, and we believe that five years' training divided between college and workshop, giving the preference to the former, are sufficient to fit a capable student of engineering to embark upon his profession with good prospects of success.

The President referred at some length to the importance of a common system of units of measurement, and again urged the merits of the metric system. In conclusion, he touched briefly upon the preliminary examination of patent specifications, which he considered of little use except for the detection of anticipations, and referred to the vast change in industrial conditions brought about by the introduction of railways, telegraphs, &c., which has thrown open the markets of the world to all comers.

The address, it will be seen, covered a wide range of matters of interest, and, while it dealt with none of them exhaustively, provided abundant food for thought in many directions.

The Theory of Coal Combustion.

Recently Prof. Sir Oliver Lodge gave one of his occasional lectures to students and engineers at the Birmingham University. It is satisfactory to see that he chose for his subject "Combustion and Stoking," directing attention first to the materials of combustion and their calorific value, and pointing out that the gases which contained the most carbon yielded the greatest amount of heat; we presume that temperature was what Sir Oliver named, and not simply calories. The lecturer referred to the effects of supplying burning fuel with partially deoxidised air, and to the defect of the closed stove, which is really a gas producer, and very usually manufactures carbonic oxide to escape up the chimney.

A closed stove ought, of course, to have an air admission at the top, and the flue for some distance should be gilled and treated as the radiator of heat. Experience shows that an ordinary house stove of small size, with a 3½ in. thin flue pipe about 20 ft. long, will maintain that pipe so hot that, at the end of the 20 ft. run, it can barely be touched by hand. A close stove should, therefore, have a considerable area of cooling surface provided beyond the stove proper, and unless air is admitted to burn the carbonic oxide above the fuel, fully two-thirds of the fuel may be wasted. This was practically what Sir Oliver's advice about stoves amounted to.

In referring to the important subject of stoking, Sir Oliver did what we have been doing for some years. He treated of ignition temperatures, and pointed out the cooling effect of boiler plates upon half burned gases, illustrating his remarks by the action of the gauze of the safety lamp. He condemned water-tube boilers as unsuccessful, because of the cooling effect of their tube surfaces, which make contact with the gas before it has had time to mix with air and burn at a sufficient temperature. He advocated refractory linings for the purpose of conservation of temperature while combustion was proceeding, and for promoting radiation when this in turn became requisite. Generally, he claimed all that we have been advocating, and it is certainly satisfactory that a scientific professor of Sir Oliver's high attainments should bend some of his energies in the direction of teaching the principles of combustion. He is almost, if not quite, the first engineering professor who has done this. There is, of course, nothing in the chemistry and physics of combustion that most of the professors have not known all along, but the trouble has been that none of the youths who have passed through their hands have received from them the benefits of correct teaching. Diagrams of boilers have been hung before them; they have perhaps even been shown how to stoke the boiler as it was, but they have not gone out into the world with the lesson burned into their brain that combustion is a chemical process which cannot be successfully and economically performed in boiler furnaces as commonly made.

Sir Oliver Lodge has, we hope, changed all this. His students at least should not go out into the world as soot manufacturers through ignorance. What soot they make will be by misfortune or wilfulness. To combat the selfish inertia of the boiler maker who cares for none of these things, requires the strenuous aid of all who have the voice and the position to make their views heard. With Sir Oliver Lodge openly on our side we are the more emboldened to declare once again that smoke is not an unavoidable nuisance, nor should its avoidance necessarily cause loss. Rather it should indicate perfect combustion with minimum air supply, and, therefore, assist towards improved efficiency.

Who is Liable?

A case is reported this week which involved the question as to who is liable for an accident caused by negligence in laying down an electric tramway. It appeared that on July 14th, 1903, a man named Saunders was driving a lorry in the Old Kent Road, at a place where a temporary tramway had been laid for the purpose of carrying out the more permanent work of laying tramlines on the conduit system for the London County Council. The lorry collided with a manhole which was not properly laid, with the result that Saunders was thrown and injured. He brought an action against (*a*) the London County Council, who were converting their tramway system in the Old Kent Road to electric tramways; (*b*) Messrs. Reid Bros., who had contracted with the County Council to provide the electrical ducts and conduits, and to make the manholes in connection therewith; (*c*) Messrs. White & Co., who had made the temporary tramway under contract with the County Council; (*d*) the Southwark Borough Council. When the case came on for hearing, the last two sets of defendants were struck out. The jury found that the accident was occasioned by reason of the defective condition of the road surrounding the manhole, and that the defective condition was occasioned by the negligence on the part of Messrs. Reid, and in the event judgement was entered as against Messrs. Reid, damages having been assessed at £125. It is understood that as the County Council were indemnified by Messrs. Reid, they will have to pay no part of the damages.

It may be thought surprising that the plaintiff went to the trouble of joining so many defendants to his action, but it must be borne in mind that liability for negligence in the performance of a statutory duty cannot be delegated. In a case which was decided in 1902, a town council who were the owners of tramways, entered into a contract with a contractor, whereby the latter undertook to do the whole of the work of equipping the tramways for electric traction. The contractor entered into a sub-contract, whereby the sub-contractor agreed to do part of the work, namely, the erection of the iron standards along the streets, and the fixing of the wires thereto. For this purpose the sub-contractor used a tall derrick, which was a usual structure to employ in executing work of this kind, and his workmen, on leaving off work, negligently left the derrick too close to the tramlines. The plaintiff, who was riding on a tramcar, was injured. In an action against the driver to recover damages,

it was held that as the work was being done on a highway, it was the contractor's duty to take reasonable precautions to protect the public, and that he could not escape from that duty by delegating the work to a sub-contractor; that the act of negligence was not merely casual or collateral, and that the defendants were liable. But it must be remembered that if injury is caused by non-repair of a highway, it is the person or body liable to repair who are liable. So in Barnett *v.* Poplar Borough (May, 1901), where, by a contract with a tramway company, the road authority has undertaken the repair of that portion of the road which the tramway company are bound under Sec. 28 of the Tramway Act, 1870, to keep in repair, the liability for injuries caused by non-repair of that portion of the road is transferred to the road authority.

Liability for Tramway Accidents.

A FEW weeks ago, when writing on this subject, our legal correspondent made certain comments on the legal aspect of the action of the Sheffield Corporation in trying to shirk responsibility and limit its compensation liability for accidents occurring to passengers while travelling in the electric cars. It will be remembered that the Corporation tickets had on the back a notice limiting the liability to a maximum of £25, a procedure which naturally gave rise to opposition. We gather that the main object in printing the tickets in this fashion was to prevent the Corporation being unfairly dealt with, and in proceeding along this line of argument, Alderman Clegg showed that when such matters were left to courts and juries to settle, claimants received far more than they ever expected to obtain by way of damages. He instanced a case where a sympathetic jury had awarded £590 as damages, whilst the claimant's solicitor would have accepted much less. Be that as it may, the position could not be fairly got over by attempting to place the maximum at £25, however culpable the Corporation might be, and however serious might be the personal injury sustained by a passenger. We are glad to learn that at last week's meeting the Sheffield Corporation admitted that a mistake had been made, and by 54 votes to 3 (four Councillors were neutral) resolved that the notices should be withdrawn, both from the cars and from the tickets.

Councillor Muir Wilson, a local solicitor, who has interested himself in the subject for some time past, can claim to have removed what has been the cause of a real grievance among Sheffield tramway passengers. We have sympathy for tramway undertakers in their efforts to keep the compensation account as low as possible, but it must be done in common-sense ways. Every reasonable precaution must be taken for ensuring safe running. In these days no attempt to shuffle out of responsibility is likely to be approved either by the public or by the Courts.

The London Building Acts.

MANUFACTURERS who have had experience during the last few years in the erection of factories in London, and have time and time again been seriously hampered by the London Building Acts of the London County Council, will learn with some amusement that the Council is now embarrassed in regard to its tramway buildings by the requirements of these very Acts. At Tuesday's meeting the Highways Committee reported having considered the provisions of the Council's London Building Acts Amendment Bill, in so far as they relate to tramway buildings. Certain difficulties had been experienced from time to time owing to the limitations contained in the London Building Act, 1894, as to the cubical extent of buildings, and Secs. 80 and 81 of the new Bill would deal satisfactorily with that point. The size and special character of buildings used for electric tramways made it extremely important that the exemptions in those respects accorded by Sec. 203 of the London Building Act, 1894, to buildings of certain descriptions, should be extended to tramway structures. In these circumstances the Committee expressed the hope that every effort would be made to secure the passing of the Bill in the next session, so as to secure those objects.

THE UNIPOLAR DYNAMO.

THE old problem of the commercial application of unipolar dynamos is discussed in some detail by J. Seidener in a recent number of the *Zeitschrift für Elektrotechnik*, more especially with reference to their combination with steam turbines.

The writer points out that the great advantage of these machines is the sparklessness of the current collection, owing to the absence of a commutator, while at the same time one of the chief difficulties experienced with them in practice is connected with this very point of

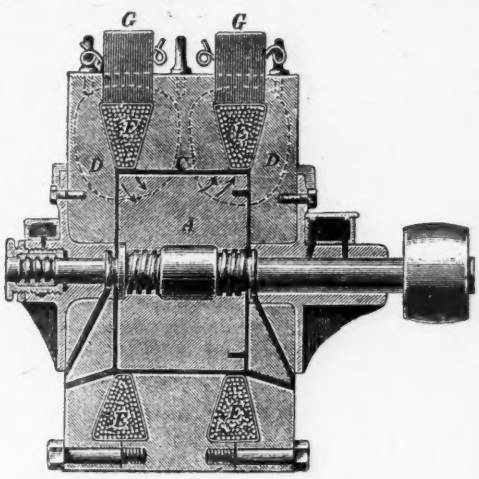


FIG. 1.

current collection. The high peripheral speeds demanded for the production of ordinary working voltages without an excessive expenditure on material, involve a high friction loss at the collecting brushes, especially if the revolving surface is at all out of truth, as that, naturally, necessitates a high brush pressure in order to prevent vibration.

On this account the well-known Forbes unipolar machine (fig. 1), with a solid cylindrical armature and the current collected at the two ends of the cylindrical surface, is especially difficult to deal with, as the exact balancing of a massive cylinder is almost impossible.

When the armature, however, takes the form of a thin disk (fig. 2), this difficulty is much more readily overcome,

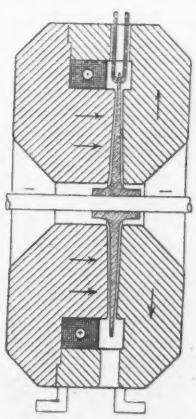


FIG. 2.

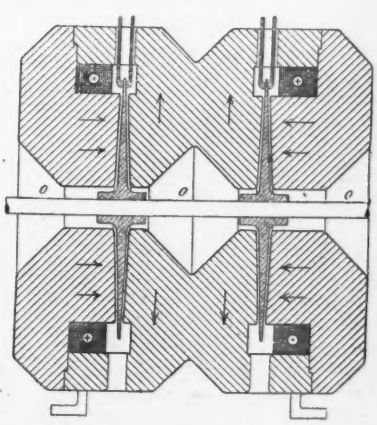


FIG. 3.

chiefly because a thin disk can be more easily obtained of homogeneous quality throughout than a solid cylinder. Comparing fig. 2 with fig. 1, a little consideration will show that for the same number of revolutions per minute and the same external diameter of rotating part, the disk machine will only develop half the E.M.F. of the cylinder machine, though at the same time the weight of material in the disk

machine is only half that in the cylinder machine. In order to obtain the same E.M.F. in both cases, it would be neccessary to employ two disk machines in series. Now, in the cylinder machine current collection takes place at two points, both at the maximum peripheral speed. Two disk machines would, together, require four collecting points, of which two would be at the maximum peripheral speed, and two at the minimum peripheral speed, *i.e.*, on the spindle. The two latter collecting points, may, however, be eliminated if the two spindles are electrically connected together, and the direction of excitation of the two field coils is arranged so that the two voltages act in series through the spindle. In this case (shown in fig. 3), the disk machine has only two collecting points, at the maximum peripheral speed, just as in the case of the cylinder machine, and the complete weight of material in the two types is the same. Such a two-disk machine is, incidentally, capable of acting as a three-wire dynamo if the middle wire is connected to the spindle. Each side can have its voltage independently regulated by means of the exciting coil on that side.

It may be pointed out that the dimensions of a unipolar machine depend far more on the voltage required than on the current. The section of material between the points of maximum and minimum potential in the rotating part is, from mechanical and magnetic considerations, already so large, that it makes little difference whether the machine is intended to give 10 amperes or 1,000 amperes. It is clear, on this account, that these machines cannot advantageously be built for small outputs, and are especially suitable for comparatively small voltages and large currents.

Armature reaction, in the ordinary sense of the term, is practically absent, partly because of the low value of the amperes per unit length of armature periphery, and partly because, from the arrangement of the machine, actual armature reaction of the sort that exists in ordinary machines cannot occur.

The collection of the currents, both in the cylinder and in the disk type of machine, is greatly improved if, in place of using the cylindrical outer periphery as the collecting surface, part of the circular end surface is used for this purpose.

Though there is great difficulty in obtaining a truly cylindrical surface (even if the final trueing up is carried out at the actual working speed), yet the side faces of a disk made of homogeneous elastic material will approximate more and more to a perfectly flat surface, the higher the speed at which the disk is rotated. With regard to strength the disk of a unipolar machine is even better off than a de Laval turbine wheel, as the former, when sideway current collection is employed, need not even be thickened at the outer periphery, and so has no additional weight to carry there.

In the case of small moderate speed machines, the disks would usually be made of material of high electrical conductivity, but bad magnetic quality, such as hard copper, bronze, &c. For large machines and high speed machines generally, the thickness of the disk near the spindle necessitated by mechanical considerations would be so great that the air-gap at the inner portions of the disk would become excessive, and make these inner portions almost valueless as far as the production of E.M.F. was concerned. If, however, steel or iron is employed as the disk material, the only air-gap in the path of the flux is the sum of the clearances on the two sides of the disk, and this leads to a great saving in the weight of exciting winding required, as compared with the non-magnetic disk type. Since all parts of the disk are at all times in a field of the same density, no hysteresis loss can occur.

There is, however, some danger of a one-sided magnetic drag on the disk owing to the fact that some magnetic leakage occurs at the outer periphery of the disk, giving a higher flux density on one side of the disk than on the other. This difficulty can be avoided by replacing each of the exciting coils shown in fig. 3 by two equal coils, placed one on each side of each disk, thus making the arrangement about each disk symmetrical and preventing all peripheral leakage.

The employment of disks of magnetic material and the avoidance of all thickening of the disk at the outer periphery for collecting purposes (by collecting the current from the side faces) enables extremely high speeds to be utilised, and the writer is of opinion that the introduction of machines of this double disk unipolar type is likely to receive a considerable impetus in connection with the manufacture of steam turbines, both on account of the high speeds involved, and also because the manufacture of steam turbines has led to increased experience in the construction of high speed machine parts. In any case, in view of the difficulties met with when constructing ordinary direct current dynamos for coupling to steam turbines, both as regards commutation and the high centrifugal forces involved, a re-consideration of such unipolar machines would seem to be justified.

In order to show the sort of dimensions necessitated with this type of machine, the results of a series of calculations on

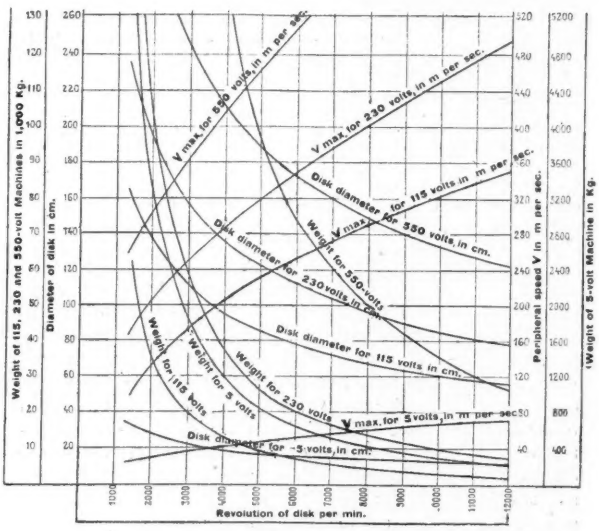

Weight of 115, 230 and 550-volt Machines in 1,000 Kg.
Diameter of disk in cm.
Peripheral speed V in m per sec.
Weight of 5-volt Machine in Kg.
V max for 550 volts, in m per sec.
V max for 230 volts, in m per sec.
Disk diameter for 115 volts in m per sec.
V max for 350 volts, in cm.
Disk diameter for 350 volts in cm.
Disk diameter for 230 volts in cm.
Weight for 350 volts
Weight for 115 volts
Weight for 5 volts
Disk diameter for 115 volts in cm.
Weight for 230 volts
V max. for 5 volts, in m per sec.
Disk diameter for 5 volts, in cm.
Revolution of disk per min.

FIG. 4

machines for 5 volts (plating dynamos), 115 and 230 volts (lighting dynamos), and 550 volts (traction dynamos), are shown in fig. 4. The magnets were in all cases assumed to be of cast-steel, the flux density in the air and in the steel was taken as B = 15,000 C.G.S. lines per sq. cm., the voltage drop in the disk was neglected, the projecting part of the disk used for current collection was taken as ·05 D where D = outer diameter of disk in cm., the air-gap was assumed to increase directly with the diameter of the disk, so that the section of the exciting coils also increased proportionately to the diameter. The inner diameter of the disk was taken as ·15 D, so that the active radial length of pole face $= l =$ ·375 D, and the average peripheral speed in metres per second $= v = \frac{\pi \times \cdot 525\ D \times n}{60}$, where n = number of revolutions per minute.

The E.M.F. induced in the two disks together is—

$$E = \frac{2.l.v.B}{10^8} = \frac{2 \times \cdot 375\ D \times \pi \times \cdot 525\ D \times n \times 15{,}000}{60 \times 10^8}$$

$$= 3{\cdot}08\ D^2.n.10^{-6},$$

or $$D = 570\sqrt{\frac{E}{n}} \text{ in cm.}$$

The weights shown on the curve were obtained by proportion from a single complete working, assuming that the weight varied as the cube of the diameter of the disk—the expression being : Weight in kg. = ·0146 × D^3.

Machines of this type show a decidedly lower proportion of labour cost to cost of material than in the case of ordinary machines, principally because their massive build necessitates very little machining. The ratio of copper weight to steel weight is also very low. With a 5-mm. air-gap on each side of the disk, and a disk about 100 cm. in diameter, this ratio worked out at only 3 to 3½ per cent.

GIBSON PATENT ELECTRO-PNEUMATIC ROCK DRILL.

The rapidly increasing use of electrical power in mining operations of all kinds has given rise to a demand for an efficient and reliable electrical rock drill, which shall combine the advantages of the well-known pneumatic drills with those of electric power transmission, and many inquiries for such a drill have reached our hands during the past year or two. Although the pneumatic type of drill

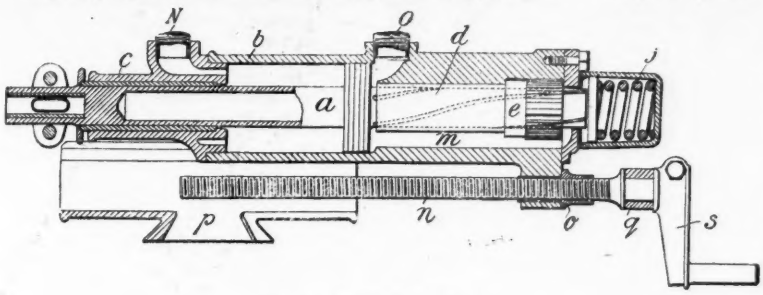


Fig. 1.—Section of Drill.

and air-compressing plant has attained a high degree of perfection, the cost of drilling by this means does not materially differ from that of hand labour, and the main advantage which it possesses lies in the greater speed with which the operation can be carried on. The working efficiency of the pneumatic system—horse-power at drill: compressor I.H.P.—is only about 10 per cent., so that so far as regards the consumption of energy, the electrical drill has a large margin to work upon.

The intention of this article is to describe a new type of electric rock drill, which appears to possess decided advantages over earlier devices, and is the invention of Mr. A. H. Gibson, of 12, Station Avenue, Kew. The cross-sectional drawing (fig. 1) given herewith shows the mechanism of the "stoping" drill, from which it will be seen that the operation of the machine is essentially pneumatic; the air cylinder, *b*, however, is larger in proportion, and there is absolutely no valve-gear or any substitute therefor. The sleeve *d* provides for the rotation of the drill shank *a*, and the recoil is cushioned by the spring *j*, while the screw *n* controls the feed. The front and back ends of the cylinder are connected by a pair of hose-pipes N, O to a separate apparatus, consisting of an electric motor coupled to an air "pressor"; the latter is simply a cylinder with the above-mentioned hose-pipes connected to its ends, and contains a piston. When the piston is reciprocated by the electric motor, the rock drill piston is rapidly reciprocated also, with the aid of a valve situated in the small cylindrical cover shown in the illustration (fig. 2) of the pressor and drill disconnected. Fig. 3 shows the apparatus in its working condition.

The motor is of the three-phase type, giving 2 H.P. at 200—220 volts, 50 cycles per second; in operation the motor is simply switched on, and the drill is controlled by a hand air regulator.

The first drill tried underground was a small one, of inferior design compared with the one which we illustrate; the results, however, were most encouraging, and the drill was worked day and night by ordinary miners for a month. Careful accounts of the expenses were kept, and although much of the plant was improvised for the occasion, the cost was found to be much less than that of hand labour. The "footages" per shift of eight hours ran up to 33 at times.

Where electrical energy can be purchased, the capital cost of the electric drilling plant is more than 50 per cent. less than that of compressed air drills, whilst even where the user must provide the power, the cost is said to be 35 per cent. less.

The great difference in cost is due to the fact that only one-fourth as much power is required by the electrical drill, as compared with the pure pneumatic drill, so that the generating plant costs far less in proportion.

The facility with which electric cables can be removed and relaid

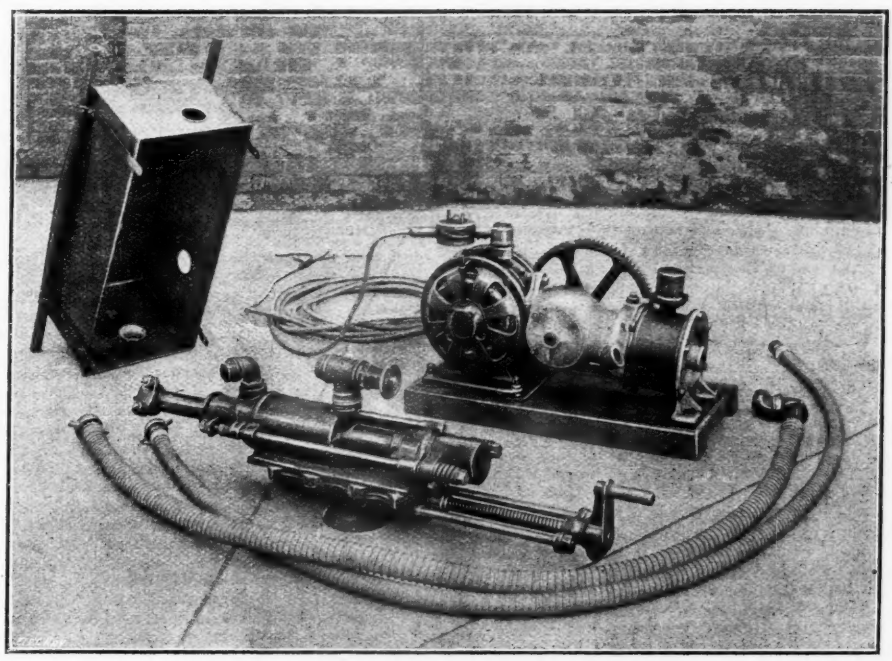


Fig. 2.—Electric Pressor and Pneumatic Drill.

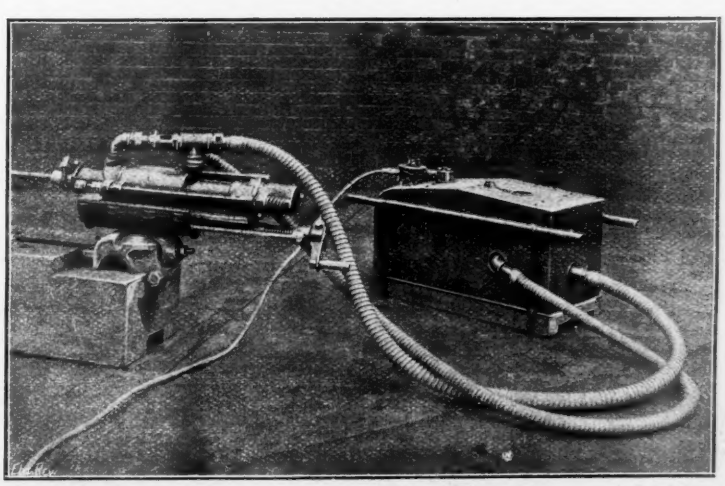


Fig. 3.—Gibson Electro-pneumatic Drill in Working Order.

again and again is also an important point, as compared with the iron pipes used for compressed air transmission. Moreover, the electric system supplies light as well as power—a function which can never be filled by compressed air.

Recent tests of the drill show that holes $1\frac{5}{16}$ in. in diameter were drilled through 23 in. of hard granite in $4\frac{3}{4}$, 5 and $5\frac{3}{4}$ minutes, with consumptions of ·160, ·183 and ·180 unit respectively.

The weight of the stoping drill is 168 lbs., and that of the motor and pressor 300 lbs.; the length of stroke is 6 in., and the drill drives 4-ft. holes, striking 375 blows per minute, and taking 1,520 watts at full load.

It will be seen that the principle of the drill is the same as that of the pneumatic power hammers, which have been so successful, and having regard to the extreme simplicity of the mechanism, its portability and high efficiency, the Gibson rock drill ought to fill an important place in mining work.

INSTITUTION OF ELECTRICAL ENGINEERS.

Abstract of Presidential Address read at Dublin, November 10th, 1904, by Mark Ruddle, City Electrical Engineer.

The right of electrical engineering to be termed a profession has sometimes been questioned, but I think it is now admitted since our development has been mainly due to the efforts of a long line of experimenters and philosophers. Science, as Huxley says, is organised common-sense, and the groundwork of our claim to be a profession is the necessity for the exercise of all our past experience in the treatment of each problem as it arises—that is to say, for the application of those general principles unconsciously derived from all one has seen, or read, or thought about. The laboratory experiment of to-day is utilised in practical engineering to-morrow, and there is no other branch of engineering which so lends itself to exact mathematical treatment and demonstration. A century ago electricity seemed but a scientific toy; it is now thought by many to constitute the reality of which matter is but the sensible expression.

New uses of electricity and improvements of existing ones, so crowd upon our notice that it becomes practically impossible for an engineer in full work to keep himself abreast of the times in this respect in all branches of experiment and work. Every day is making more manifest the absolute necessity for specialisation in our profession, for, owing to the highly scientific and complex nature of the problems which have to be solved before arriving at a satisfactory method of meeting the demands of new applications and conditions, no one man can hope to have a thorough up-to-date knowledge of the whole cycle of professional work. This leads up to a most important point—viz., the training of electrical engineers with regard to their successful entrance into and practice of the profession.

A municipal engineer is often looked upon as an encyclopædia of information, as well as a universal provider of employment, and parents frequently consult me as to the easist way in which their sons can become trained electrical engineers, with, needless to say, a correspondingly satisfactory salary, and in the majority of instances leave me with a feeling in their minds that I am unduly magnifying the amount of study and training necessary before the first step can be taken upon the ladder of remunerative practical work. Man carries with him the physical texture of his ancestry, as well as the inherited intellect bound up with it, but this extends no further in the making of an engineer than giving the possession of a quick comprehension, a retentive memory, and a power of grasping problems. All else in modern engineering has to be acquired by a more or less tedious process of strenuous education. The immediate object in all systems of technical instruction is to so organise the course of study that the ultimate result shall be attained with the least possible waste of time and effort.

I shall not attempt to place before you any cut-and-dried scheme or syllabus embracing the whole art of training an electrical engineer, for that at present seems to be a matter with regard to which the most diverse opinions are held by the leading experts in technical education; and even now no one settled plan seems to meet with general approbation. This is greatly to be regretted, for upon the system of technical education to be pursued in the near future rests largely the position which will continue to be held by the Empire in the commercial markets of the world. Notwithstanding our backwardness in this matter in comparison with many parts of the Continent, we have hitherto managed to hold our own, being largely assisted by the natural resources of the country; but competition is becoming more keenly felt every year, and we cannot afford to drift along in the same old careless way.

One predominant fact appears certain—namely, that one course of general training is necessary for those men who have the ability and funds for qualification into the higher branches of the profession, and that an entirely different training is required for those who, under ordinary circumstances, will have to commence their career with the routine work of the many applications of electrical engineering. By the higher branches, I mean men who intend to devote themselves more particularly to original research and to the theoretical development of the scientific side of the profession, but this section is outside the scope of my present remarks. I feel more concern for what I may be excused for terming the rank and file of the profession, each one of whom, nevertheless, carries a marshal's baton in his knapsack, if he has been properly trained and qualified to seize the opportunity when it occurs.

The question seems to hinge largely upon the syllabus of the primary and secondary education received up to the age of 16. This should have comprised, in addition to the ordinary subjects of general education, a good grounding in algebra, Euclid, elementary physics, and, if possible, either French or German, or both. If in the secondary school there is even a small workshop, a very valuable amount of knowledge could be imported in the elementary principles of simple tools and machines. Whatever the course of training to be pursued after this age, full advantage cannot be taken of it if the secondary education has not been directed with a definite idea of the engineering object in the future, for inadequate preparation means that much valuable time must be lost in preparatory work after leaving school. After this period two general courses of training are open to the student, each having strong advocates and, consequently, neither giving universal satisfaction. First, he may enter a suitable engineering works and spend two to three years in learning as much as possible of machine work, turning, fitting, &c, together with some experience of drawing office work. After this, having gained an insight of practical everyday work, he may enter an engineering college for thorough training in the theoretical side of his work. On the other hand, he may, on leaving school, at once take up theoretical work in a well-equipped technical college, and after, say, a three years' course, he may enter an engineering works with an eye to one particular branch of professional work or to gain all-round experience. The latter course has much to recommend it, as there is then no break in the educational course such as must occur if the student goes into a workshop straight from school, and after leaving the latter, has to resume the habit of learning and of routine study, which is not always an easy task. It is also not advisable in all cases for a youth to be subjected at such an early age to the influences of ordinary workshop life, which he is not always able to withstand, and finds difficult to shake off on entering the training college; while if he first enters the latter, his character will be sufficiently formed when the time comes for leaving.

There is, however, a middle course which is often recommended for those students who are unable for various reasons to spare sufficient time to take full advantage of the general training I have mentioned—that is, to enter a works for practical training and to work up the theoretical side in evening classes Except where no other course is possible, I do not recommend this plan. It is hard for a youth of 16 or 17 to keep ordinary shop hours at mainly physical work and to give up the majority of his evenings to private study or attending technical classes, and I am not sure that it is unattended with danger to his proper physical and mental development. A growing youth must have time for recreation and rest, and success is dearly bought at the expense of a debilitated constitution. Still, there are cases in which there is no option but to pursue this plan; but men so trained cannot expect to compete on equal terms with those who have had a more liberal course of study, except in cases of unusual ability and aptitude.

Much, however, depends upon the student himself. If he has an innate love of the science and art of electrical engineering, and of learning for the sake of finding out hidden things; if he has the earnest desire to attain to as near the front rank as his capabilities will permit, and has the physical and mental constitution to stand the strain of burning the candle at both ends, so to speak, he will, with average good fortune, attain his end more surely than many others who start under apparently more favourable auspices, for, having the self-stimulus of an insatiable knowledge-hunger, he is in closer sympathy with his teachers, and does not wait to be spurred on in his work. And this is the true spirit which should animate those seeking to enter our profession. Its devotees must give more than lip-service—answering of examination questions and obtaining passes and certificates—for, as you know, these alone are no test of a man's fitness, and, in fact, are often the cause of much wasted time by giving a premium to those who best develop a parrot-like facility of answering set questions, rather than probing the depth of the information they have assimilated. In saying this, I must not be taken as considering these examinations entirely useless, for they undoubtedly do serve a useful purpose in separating the earnest student from the merely brilliant one. The failures in formal examinations often provide the most reliable raw material to be worked up afterwards, as only those who have grit in them continue to persevere as usual in spite of their failure to pass, and this determination to persevere stands to them in their after career, for it must never be forgotten by those who would be successful that they must be students all their lives. There is no such thing as finality in the knowledge of electrical engineering—a week now is more pregnant with discovery than 100 years were formerly, and those who desire to keep in the front ranks must keep pace with the times in their special spheres of work.

A serious danger is now developing owing to the great inrush of young men into anything electrical in name; many of them seem satisfied to acquire just enough technical knowledge to secure a post. Once secured, they settle down and perform their routine duties more or less thoroughly, and gradually drift out of keeping their training up to date. Football, cricket, cycling, and often matrimony, or the preliminary stages of it, claim their leisure hours entirely, and even when on duty they occupy such idle moments as occur between the intervals of actual work in the perusal of sporting or sensational literature, rather than in anything bearing on their professional work. Time goes on, and opportunities occur for promotion or for entering fresh fields of work, and they find that they stand no chance against competitors of more modern training from not having kept their knowledge up to date. It is not enough to have sufficient knowledge for present needs; one must look ahead, and be prepared for developments.

I have hitherto dealt principally with the technical side of a student's training, but before a student can expect to secure a

position of any importance he has yet to acquire the commercial or business side of his education. No technical training institute can teach a student how to handle workmen, or how to turn out finished plant from a workshop at commercially remunerative prices, nor would it be reasonable to expect it to do so, for such knowledge can only be gained in the hard school of practical experience, and learnt little by little as opportunity offers. And yet such is the ultimate object of all professional training in the majority of cases, for the most perfectly and scientifically designed scheme is quite valueless unless it can be made a commercially financial success. Students should, therefore, take every opportunity of seeing works in practical progress; they feel utterly at sea with regard to much that goes on, but to an observant mind there are many object lessons to be learnt, and hints obtained that will be of much service in after life. I have often been struck with the apathy displayed by the majority of students when given the opportunity of visiting works in process of erection, or in actual everyday running; they ask no questions, and apparently look upon the whole thing as a bore, or an opportunity of escaping a regular class lesson at best, instead of regarding it as a unique chance of seeing practical engineering works and life, into which they may hope one day to enter. It is most depressing to those who have to show them round, and desire to make the visit interesting and instructive to those who may be their colleagues or successors at some future time, to find that so little interest is taken in what is going on, and they feel quite relieved and grateful when one of their visitors asks the most trivial question upon any point. Ask questions about everything is my advice to students; never mind whether they may appear foolish or trivial; give evidence in some way that you appreciate your opportunity, and you will gain many valuable hints for your future work, and render the task of your instructors a little easier.

I may here express a word of sympathy for the teachers and instructors in technical institutions, for theirs is, indeed, a difficult task. Too often they are unjustly blamed for being unable to meet the demand for trained men to fill the ranks of workers in technical industries, but they do not always deserve that reproach. Some there are, no doubt, who become teachers because the position gives them the means to live, but I know of many earnest capable men who are animated by a keen desire to fit their pupils in the best possible way to meet the battle of life, and yet are handicapped by themselves not having a practical knowledge of technical work and the requirements of employers in the various industries. They are, therefore, unable to so shape their course of training that it prove suitable, and being themselves cognisant only of a college course, they naturally follow on the same lines. This is not altogether their fault; it reflects, mainly, upon the leaders of industry and large employers, who, for the most part, take but little interest in the training of the raw material from which their employés are drawn, and who have not realised that it is to their own interest, as well as that of the country at large, that they should co-operate with the teaching bodies, and assist them, by both advice and funds, in being properly provided with the most suitable staff and general teaching equipment.

GAS COMPANIES AND ELECTRIC LIGHTING COMPANIES.

[FROM OUR LEGAL CONTRIBUTOR.]

It is not often that cases involving the settlement of disputes between electric lighting and gas companies come before the Courts for decision. The occurrence of any such case draws attention to the fact that an electricity supply company, in carrying out the works which may be necessary for the proper supply of electricity, must pay due attention to the presence of gas-pipes or mains in any position where they may be interfered with.

A recent case in the King's Bench Division—*e.g.*, Chepstow Electric Light and Power Co., Ltd., *v.* Chepstow Gas and Coke Consumers' Co., Ltd., which was reported in our issue of November 11th—shows that if an electric company neglects to obey the lawful requirements of a gas company, they may be exposed to heavy penalties. The facts of the case may be thus epitomised. In 1903, the Chepstow Electric Light and Power Co., Ltd., laid down and constructed new electric lines and other works in certain streets within their limits of supply. Prior to this, they had had a dispute with the Chepstow Gas Co. as to the position in which these mains should be laid. The right of the gas company to interfere in the matter was conferred by certain provisions in the schedule to the Electric Lighting (Clauses) Act, 1899, Sec. 18 (1), of which provides that where the undertakers require to dig or sink any trench for laying down or constructing any new electric lines (other than service lines), or other works near to which any sewer, drain, watercourse, defence or work under the jurisdiction or control of the local authority, or any main pipe, siphon, electric line, or other work belonging to any *gas*, electric supply, or water company has been lawfully placed, or where any gas or water company require to dig or sink any trench for laying down or constructing any new mains or pipes (other than service pipes) or other works near to which any lines or works of the undertakers have been lawfully placed, the undertakers or the gas or water company (as the case may be) in this Section referred to as "the operators" shall, unless it is otherwise agreed between the parties interested, or in the case of sudden emergency, give to the local authority, or to the gas, electric supply, or water company, or to the "owners," not less than three days' notice before commencing to dig or sink such trench as aforesaid, and those owners shall be entitled by their officer to superintend the work, and the operators shall conform with such reasonable requirements as may be made by the owners or the officer for protecting from injury every such sewer, drain, &c., and for securing access thereto, and they shall also, if required by the owners thereof, repair any damage which may be done thereto. By Sub-Sec. 4 any question or difference which may arise under the section is to be determined by arbitration. By Sub-Sec. 5, if the operators make default in complying with any of the requirements of the section, they must make full compensation to all owners affected thereby for any loss, damage, penalty or costs which they may incur by reason thereof; and, in addition thereto, they are liable for each default to a penalty not exceeding £10, and to a daily penalty not exceeding £5. Early in 1903, a dispute arose between the gas company and the electric company. This dispute was referred to arbitration, and on February 12th, 1903, the arbitrator found that the electric lines were in undue proximity to the gas pipes and that the electric company had not obeyed the requirements of the gas company. On May 31st the gas company made complaint before a Court of summary jurisdiction, that on and since October 2nd, 1903, the electric company had made default in complying with the requirements of the section above quoted. A summons was issued, and heard on June 17th, when it was proved that the electric company had not complied with the requirements of the gas company, and that, since the date of the arbitrator's award, no steps had been taken to alter the position of the wires. The electric company took the objection that the complaint was not made within six months of the time when the matter of the complaint arose, as required by Sec. 11 of the Summary Jurisdiction Act, 1848, which provides that in all cases where no time is already, or shall thereafter, be specially laid down for making any complaint or laying any information in the Act or Acts of Parliament relating to each particular case, such complaint shall be made, and such information shall be laid within six calender months from the time when the matter of such complaint or information respectively arose. On the part of the Gas Co. it was contended that the offence was a continuing one, and that, therefore, the time limit did not apply, and that even if it did, the period of six months commenced to run from the date of the award, namely, February 12th, 1903. The magistrates over-ruled the objection, and fined the company £1 and costs, and a daily penalty during default of £1 a day. From this conviction the company appealed to the Divisional Court, and subject to striking out that part of the order which related to the payment of future penalties, the conviction was confirmed. In dealing with the objection that the summons was out of time, the Chief Justice said:—"I am clearly of opinion that this was not an objection making the conviction bad on the face of it. When one is dealing with non-conformity with a requirement, that contemplates something which takes time; and to say that the time begins to run from the date of the requirement itself is obviously impossible. I can imagine a thing that is ordered to be done, requiring so little time, that the magistrates might well think that there was a complete offence more than six months before the laying of the complaint. In view of the facts found in the case, that exception, if it is an exception, cannot arise here. Here the appellants are disputing the contention that the lines were too near the gas mains for more than four and a-half months after the question was raised. It is not possible for the Court to consider this conviction as alleging a completed offence on October 2nd, in respect of which the penalty might have been inflicted. There is nothing to show that the offence was complete more than six months before the summons was taken out."

In view of certain decisions which were cited to the Court, the above reasoning is somewhat difficult to follow. For instance, in the case of Hull *v.* the London County Council ((1901) 1 Q.B. 580), the facts were shortly these. By Sec. 73, Sub-Sec. 8 of the London Building Act, 1894, "No projection from any building" (except certain specified projections) "shall extend beyond the general line of buildings in any street without the consent of the London County Council. The appellant was convicted on an information charging him with the offence specified in Sec. 73 (8) of the London Building Act, 1894, the projection complained of being a wooden case attached to the external wall of a building by iron brackets, and used as an advertising stage. It had been up more than six months before the information was laid. It was decided that the conviction was wrong because, first, *inter alia*, the prosecution was barred by Sec. 11 of the Summary Jurisdiction Act, 1848.

The Divisional Court, however, held that this decision had no application, and declared in favour of the gas company. In the result, unless the electric company care to submit to the payment of a continual daily penalty, they will have to relay their mains in accordance with the requirements of the award made by the arbitrator.

In view of the decision that the company must pay penalties, it is exceedingly difficult to understand the precise object of the arbitration proceedings. They were probably instituted with the precise object of setting at rest all disputes between the gas company; yet as soon as the award was given it was practically wholly ignored by the gas company who insisted that the work of removing the mains from a position of undue proximity to the gas pipes should be carried out by the Electric Light & Power Co.

It has since been stated that for the purposes of the arbitration several portions of the streets were opened up, and that the arbitrator awarded the gas company some £36 in "full compensation." If this sum was accepted upon the understanding that the electric company were to carry out the alterations after all, what was the £36 for? It is true that under the section above set out a company may be liable to penalties in addition to the cost of doing

all necessary alterations and repairs, but that they should be mulcted in penalties when a sum of money has been paid in "full settlement" appears to be hard in the extreme.

Without seeing the full terms of the reference to arbitration, it would be impossible to ascertain whether the arbitrator's award has been evaded or not.

Too much stress must not be laid upon the decision in this case. In the first place whatever may be the real facts, it appears to have been decided upon the supposition that the only question before the arbitrator was whether the mains had or had not in fact been laid too close to the gas mains. As the case is reported it does not appear that the arbitrator was called upon to order the electric light company to do the work or to pay the gas company for doing it themselves.

While upon the legal relationship of gas company and electric supply company, it may be of interest to consider the question as to who is liable for damage caused if an explosion should take place in a street box, owing to the accumulation therein of gas which escapes from gas mains. Under the present Electric Lighting Acts, and the regulations made thereunder by the Board of Trade liability does not appear to attach to one authority more than another. Nevertheless, the onus is upon the electric lighting company to keep such boxes clear of gas. Thus, by the Board of Trade regulations (No. 34 of 1895), under the heading "Street Boxes," it is required that "(*c*) Where street boxes are used as transformer chambers, reasonable means shall be taken to prevent, as far as possible, any influx of water, either from the adjacent soil, or by means of pipes; and in the case of any such street box exceeding 1 cb. yard in capacity, ample provision shall be made, by ventilation or otherwise, for the immediate escape of gas which may by accident have obtained access to the box, and for the prevention of danger from sparking. (*d*) All street boxes shall be regularly inspected for the presence of gas, and if any influx or accumulation is discovered, the undertakers shall give immediate notice to the authority or company whose gas mains are laid in the neighbourhood of the street box."

Although these rules impose upon the electric company the clear duty of seeing that gas is not allowed to accumulate, they say nothing upon the question of liability. The question must, therefore, be answered independent of statute. In the first place, neither gas nor electrical companies are exempted from liability for negligence. To whose negligence, then, can the explosion of a street box be ascribed? It seems that there must be negligence on both sides; on the part of the gas company in allowing their pipes to become leaking, on the part of the electric supply company in permitting the street box to become so defective as to allow of the percolation and accumulation of the explosive mixture. It is impossible to see how such an accident could be attributed to one or other company, unless, of course, it could be shown that the gas was fired, not by a short-circuit, but by a lighted match or other adventitious cause.

Should the question ever arise in the Courts, it is probable that the two companies could be joined as joint *tort feasors*.

LEGAL.

Saunders *v.* Reid Bros. & Co.

In the King's Bench Division of the High Court of Justice, on the 10th inst., the Lord Chief Justice and a special jury heard an action by Ernest Charles Saunders, a carman in the employ of Messrs. Owen & Sons, against Messrs. Reid Bros., telegraph and telephone engineers and contractors, carrying on business at New Cross, and the London County Council, for damages sustained in the Old Kent Road on July 14th, 1903, through the defective condition of the road owing to the negligence of the defendants' servants or agents. The defence was a denial of liability and of negligence.

Mr. Danckwerts, K.C., and Mr. Ellis J. Griffith appeared for the plaintiff; Mr. Clavell Salter, K.C., and Mr. J. Harris appeared for Messrs. Reid Bros.; and Mr. Dickens, K.C., and Mr. Daldy for the London County Council.

It appeared that the defendants, Reid Bros., were the contractors to do certain work for the County Council, namely, to make a trench and to lay alongside the route of the tramway a duct which carried the main cable through which the electric power was transmitted. Some ground surrounding a manhole in the roadway opposite 87, Old Kent Road was removed in the course of the operations, and this it was said was left in a dangerous and unsafe condition, the manhole being 3 in. above the road. Saunders, the plaintiff, was driving a lorry, the seat of which was elevated about 8 ft. 8 in. from the surface of the road. The lorry struck the iron framework of the manhole, with the result that Saunders was thrown from his seat and sustained serious injuries, including a fractured skull, from which he has now only partially recovered.

On behalf of the plaintiff, it was contended that the County Council and their contractors were liable, because they put the manhole there and had not taken proper, sufficient, and effective care that their operations did not leave the road in a dangerous condition.

For the defence it was contended that if there was negligence it was not that of the defendants, but that of the Southwark Borough Council in postponing the work of permanently re-instating the road, which was not done until after the accident.

The Lord Chief Justice, in summing up, told the jury they need not trouble themselves about what the ultimate incidence of the liability would be. If anybody, a public body, or a private individual, undertook to interfere with a public highway under statutory powers, he must not act negligently. If by negligence or want of proper care, an accident arose, then that person was responsible. The first question the jury had to decide was whether the accident was occasioned to the plaintiff, by reason of the defective condition of the road surrounding the manhole. The second question was whether the defective condition of the road was occasioned by the negligence, or want of care, on the part of the servants of the London County Council, the servants of Reid, or Messrs. J. G. White (another contractor for the Council), or the Borough Council. There was no substantial evidence of any negligence on the part of the Borough Council at all.

The jury found that the accident was occasioned by the condition of the road surrounding the manhole, and that the defective condition of the road was occasioned by the negligence or the want of care of the servants of Reid Bros. The other defendants were exonerated. Damages were assessed at £125.

Judgement was entered for the plaintiff for £125, with costs, against the defendants, Reid Bros., and the London County Council, their employers.

Thompson *v.* Mackie & Co.

In the King's Bench Division on the 9th inst., before Mr. Justice Lawrence and a common jury, William Thompson, a lift man employed at Messrs. Mann, Crossman & Co.'s Brewery in the East End, was awarded £80 damages for personal injuries against Messrs. Mackie & Co., electric light manufacturers. Employés of the defendant firm were engaged in re-wiring the electric lifts at the brewery on February 8th last, and the plaintiff, who was engaged in clearing out a pit, was seriously injured in the head by the prongs of the lift, which was suddenly started by the defendant company's men. It was defendants' contention that the plaintiff must have known what was being done and should have avoided the lift.

Hawkins *v.* Reynolds.

In the City of London Court, on Friday last, before his Honour Judge Rentoul, K.C., the part-heard action of Hawkins *v.* Reynolds, already reported in these columns October 28th, 1904), was disposed of. The case had been adjourned for the attendance of a representative of the General Electric Co., Ltd., who supplied the lamps sued for, to Mr. Cairns. He said the lamps were quite satisfactory. The defendant said the lamps were sold to him on the representation that they were 144 c.p., and it would only take 30 seconds to light them. As a fact, it took six minutes after switching on the light. That sort of light was no use in business. Judge Rentoul said he should think it was quite useless. The defendant added that the Metropolitan Electric Lighting Co. paid Cairns to put in free wiring. Mr. Cairns explained that the temperature had a great deal to do with the time it took the lamp to give its proper light. The lamps in question burned in the open air, whereas the lamps which the Judge was probably more familiar with burned in a vacuum. Judge Rentoul said six minutes seemed extraordinary. Mr. Cairns explained that the lamps had to be heated first. Until the lamp was heated enough the electricity did not go through the filament, and it did not light. Six minutes was not usual, but it was quite possible. Judge Rentoul said that when a man supplied an article himself he was supposed to sell a thing that was suitable. Cairns ought to have told the defendant that the lamps would probably be unsuitable for his requirements. The General Electric Co.'s representative said the lamps were burning all over the world. Mr. Cairns added that he gave the defendant the same specification as the manufacturers gave him (Cairns). Judge Rentoul thought there had been a misunderstanding between the parties, and the best thing he could do was to compromise matters. He found for the plaintiff for £2 10s.

Mansfield Engineering Co. *v.* Wyeld.

At Mansfield County Court, the Mansfield Engineering Co., general electrical engineers, sued A. E. Wyeld, pawnbroker, of Mansfield, for the sum of £31 15s. 6d. for the installation of the electric light on his premises. Plaintiffs' case was that in August, 1902, defendant requested them to give him an estimate for the installation of 19 lights, and the estimate was verbally accepted. By October the wiring for the installation was completed, but the fittings and lamps had not been put in. At that time defendant decided to have additional lights, and to re-arrange the position of others. This necessitated considerable alteration; the whole of the wiring had to be done again, and other matters had to be altered. The original estimate was, therefore, valueless. The number of lights originally required was 19, with 11 points, whilst the number required by the alteration was 41 lights and 22 points. The work was completed before June, 1903, and was passed as satisfactory by the Corporation's electrical engineer. When the account was delivered the following month, defendant said the amount was more than he had expected. During September a fault had occurred, and was rectified without charge. Later, defendant was asked to pay his account, and on October 13th, 1904, he paid £14 into Court, and on the 18th a further sum of £11 18s., making a total of £25 13s. A counter-claim was then filed for breach of contract for £12 15s. The plaintiffs said the net cost of labour and material in connection with the installation was £24 17s. 2d., leaving a gross profit of only £6. For the defence it was contended that the original contract was for £14 6s. After the work was commenced defendant

had it extended, but he had always regarded the original contract as being in force, and was willing to pay for the extra work. When he turned on the light in June, 1903, it soon went out. He did not get what he considered a satisfactory light until September. Amongst the witnesses for the defence was Mr. William Joseph Furse, electrical engineer, of Nottingham, who said the installation was not carried out according to specification. Going through the accounts, he alleged that some of the charges were excessive. His Honour (Judge Allen) thought the charges for the work were fair and reasonable. He awarded the plaintiffs the sum claimed, less £3 8s. for ornamental brackets, painting the name on the lamp over the doorway, and for a box enclosing the wires.

Re The Northern Counties Traction Co., Ltd.

At the Chancery Court of Lancashire last week, a summons was heard against the liquidator of this company on behalf of Aubrey Ward Thomas and John Wylie Donaldson, electrical engineers, of Manchester, and Alfred Mountain Fowler, engineer, of Manchester, asking that a decision of the liquidator rejecting the proof of the applicants might be reversed, and that he might be ordered to allow such proof in full. Dr. Atkinson appeared for the applicants, and Mr. Grant for the liquidator of the company. The proof in question was for damages alleged to have been sustained by the applicants by reason of a contract that the applicants should be employed as engineers in connection with a railway scheme in North Wales. In the course, however, of the examination of the applicants' first witness, F. F. Roberts, it appeared that he was at the time of the alleged contract a partner with the applicants, Ward Thomas and Donaldson, and that the partnership was afterwards dissolved. The Vice-Chancellor, upon argument, held that, assuming there was a contract as alleged, it was a contract for personal services, which the applicants could not enforce after the dissolution of the partnership. His Honour accordingly dismissed the application with costs.—*Manchester Guardian.*

Harmer *v.* East Ham Corporation.

This was a claim for compensation, which came before the King's Bench Court on November 1st. Plaintiff, a laundry woman, got off a car in a hurry, while it was in motion, without giving, as the evidence showed, any notification to the driver to stop, and the conductor being on the roof at the time. She fell into the roadway and sustained personal injuries. The jury gave a verdict for the defendants, finding that plaintiff alighted from the car, whilst in motion, entirely at her own risk.

Ord & Maddison, Ltd. *v.* Darlington Corporation and Another.

In the Chancery Division of the High Court of Justice on Tuesday last, Mr. Justice Buckley heard the action of Ord & Maddison, Ltd., *v.* The Mayor, Aldermen and Burgesses of the Borough of Darlington and the Right Hon. John Lloyd Wharton. The plaintiffs claimed as assignees of John Robert Ord and William Henry Forster Maddison, and in their own right, an injunction restraining the defendants, their servants or agents, from excavating, building upon, or enclosing the site of the street, or intended street, known as Freeman Street, in the borough of Darlington, or any part thereof, or from otherwise obstructing or interfering with the plaintiffs' right of way over the street. They also asked that the defendants might be ordered to remove the obstruction and restore the surface of the street to its original level; and claimed damages for obstructing and interfering with the plaintiffs' right of way, and for breach of a covenant implied or expressed in a conveyance from the defendant Wharton to them. Their case was that, on or about the month of April, 1903, the Corporation began to enclose a side strip of land, forming part of Freeman Street, and proceeded to excavate and dig up the land for the foundations of buildings which they proposed to erect on it. The plaintiffs at once objected and required the Corporation not to obstruct or interfere with their right of way over any part of Freeman Street. Plaintiffs also called upon the defendant Wharton to fulfil his covenants and to secure them in the enjoyment of their right of way and their rights over Freeman Street. Correspondence and negotiations took place, but each of the defendants ultimately denied any liability to the plaintiffs, and the Corporation went on with their works. The action was accordingly commenced to enforce the plaintiffs' rights. The plaintiffs alleged that the obstruction of the part of Freeman Street by the Corporation caused serious damage to them, and if it was allowed to continue, the width of the street would be reduced from 40 ft. to 28 ft., and plaintiffs would not only be deprived of their right of way, but would be precluded from utilising their land adjoining the street for building upon it dwelling-houses of two stories in height fronting on the street, and their land would thereby be a great deal reduced in value.

The defence denied the rights of the plaintiffs under the conveyances, and said that about April, 1903, the Corporation, in pursuance of statutory powers, commenced to erect on the land buildings for the purpose of the electric tramways used in their tramcar system for the borough of Darlington. The buildings in question were of great public importance to the proper conduct of the borough system of light railways, which was of great benefit to thousands of working men and others. The piece of land as to which plaintiffs complained was essential to the use of the buildings, and if the Corporation were compelled to remove the buildings, they would suffer great pecuniary loss, and inflict discomfort and inconvenience on the public. The buildings had been erected at a cost of £8,000.

Mr. Buckmaster, K.C., and Mr. Borthwick appeared for the plaintiffs; Mr. Astbury, K.C., and Mr. Gatey for the Corporation of Darlington; and Mr. Danckwerts, K.C., and Mr. Dunham for the defendant Wharton. After hearing the arguments of counsel as to the construction of the deeds,

Mr. Justice Buckley delivered judgement, dismissing the action as against both defendants. He said the plaintiffs said there had been created in their favour rights over a strip of land some 12 ft. wide on the north-east side of Freeman Street, and that these rights had been infringed by the defendants, the Corporation and Mr. Wharton, and they sought damages. The question to be determined was whether under these deeds and upon their true construction the plaintiffs had such rights in respect of the disputed 12 ft. as they claimed. In the first place the plaintiffs claimed under a grant, which they said was made in their favour by the deed of January 25th 1896. It was plain that in January, 1896, the plaintiffs had knowledge of the agreement of March 1st, 1894. Was there any grant of a right of way over all the land called Freeman Street, and coloured blue on the plan attached to the deed? In his opinion there was not. The grant was of a piece of land along the line of Freeman Street. He conceived that there was a grant to the grantee of so much of the land lying along the indicated line, as was conveniently necessary to give him access to the premises which were being granted to him by the deed. But there was no grant to him of a right over the whole of the land coloured blue. It was plain the grantor never bound himself to make Freeman Street at all. In his opinion there was nothing on which the purchasers could found themselves for the purpose of saying this particular 12 ft. was a piece of ground over which they had the right to pass, and which must not be obstructed by the Corporation. He thought on the first ground that there was no grant, and that the plaintiff failed as against the Corporation. The other matter was whether as against the defendant Wharton the plaintiffs were entitled to recover under the covenant of the deed of September, 1899. He came to the conclusion that the covenant did not extend to this disputed 12 ft. He was unable to find in this deed that there was such a definition of Freeman Street as to show there was to be a Freeman Street extending over this disputed 12 ft. The action therefore failed as against both defendants, and must be dismissed.

The action was accordingly dismissed, the defendants being given the costs of the action, except with reference to a minor issue.

Edey *v.* Smith.

In the City of London Court, on Tuesday, before his Honour Judge Rentoul, K.C., an action was brought by Mr. F. G. Edey, trading as F. G. Edey & Co., electrical engineers, 29, Ludgate Hill, E.C., against Mr. F. H. Smith, trading as Smith & Co., of Beaufort Street, King's Road, Chelsea, for £76 for work done, and material supplied for electric lighting at certain flats. Mr. Shearman Turner was counsel for the plaintiffs, and Mr. Abinger for the defendants. The case has already been mentioned in these columns, and was adjourned for the attendance of experts. It appeared from the evidence, that the defendant was building certain flats in Chelsea, and he entrusted to the plaintiff the contract for supplying the electric lighting and electric bells. The plaintiffs' case was that he had done the work thoroughly satisfactorily, although no doubt he had been unable to complete it. That was not due to his fault, but because the defendant stopped the work. The work was done quite satisfactorily in every respect.

Mr. W. R. Woodward, past-president of the Electrical Contractors' Association, said he had had 40 years' experience of electric lighting, both mechanically and electrically, and the work now sued for had been satisfactorily carried out by the plaintiff. The witness was cross-examined to show that the society which he represented had no *status* in the electrical trade, but this he said was not true. The defendant's case was that the plaintiff agreed to give three months' credit, which had not expired. It was also said that the plaintiff had refused to complete his contract, and that the work was so badly done that the defendant could not ask for any payment for it from the Chelsea Electric Lighting Co., who were to approve of it. The electric bells which the plaintiff put up would not ring. No local authority would supply electricity to the flats in consequence of there being no fuses put in by the plaintiff. That made a constant danger of short-circuit, which might cause the houses to be set on fire. The plaintiff asserted that the bells would ring.

The case having lasted for two hours, Judge Rentoul, K.C., said that it was one of much difficulty, and he did not see how he could arrive at any conclusion which would be at all satisfactory, having regard to the numerous contradictions. He recommended that the parties should compromise the dispute. After consultation it was agreed that judgement should be entered for the plaintiff for £20 and costs in regard to one part of the contract, and that as to the rest, the plaintiff was to complete the work and then to be paid.

Rugby Engineering Society.—A meeting was held at the Benn Buildings, on 17th inst., and a discussion ensued on "The Relative Advantages of Electric and Steam Traction for Main Line Service."

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week.

The New Patent Law.

Those of your readers who are interested in patents should note the important alterations in the British law which come into force on January 1st, 1905, and include :—

1. Reduction to *six months* of the period of provisional protection.

2. Official examination into the novelty of inventions before the grant of letters patent.

The Patent Office will examine for novelty every complete specification filed in pursuance of applications bearing date after the end of 1904 ; this examination is limited in its scope to anticipations already patented in the United Kingdom within the preceding 50 years.

The applicant will be informed of any objections to his specification, and will have an opportunity of amending the same ; if he neglects or refuses to do this, the Comptroller may direct that a note be added to the printed specification, drawing attention to the anticipations.

In addition to this examination, for which the Patent Office will charge an extra fee, the Examiners are strictly directed to allow only *one* invention to be patented in each application.

The claims, moreover, must be clear, concise, and free from unnecessary repetitions. Great care will be needed to avoid undue limitation of the scope of the invention patented.

W. P. Thompson & Co.

London, W.C., *November 12th*, 1904.

Theatre Dimmer.

In connection with your notice in last week's Review with reference to the electrical installation being fitted at Mr. Maskelyne's new theatre, for his forthcoming production, "The Coming Race," it may interest your readers to know that the switchboard and regulating gear to be used for controlling the "Dimmers" referred to were manufactured by us in 1895 and fitted at the Theatre Royal, Drury Lane, from which house they were recently removed, after doing good service for about eight years, in order to make room for one of our present standard type stage regulators and switchboard.

Ernest F. Moy, Ltd.,
E. F. Moy, *Managing Director.*

Camden Town, N.W., *November 15th*, 1904.

Cost of Production and Mr. Siemens's Presidential Address.

At the present moment, when the future of our industries hangs in the balance, it is appropriate that Mr. Siemens, in his presidential address, should have drawn our attention to the fundamental factor which must govern such future. This factor is "cost of production"—nothing else matters. Yet there is a reservation from a purely philosophic point of view.

Mr. Siemens is correct in saying that "the progress of civilisation is in proportion to the cheapening of articles of consumption." From a practical point of view, not the general, but the relative, cheapening of production is of importance to us. A man or a nation is concerned to produce an article more cheaply than another man or another nation ; this sounds a prosaic reason for happiness—yet poets have expressed the same truth.

Emerson says :—"If a man can write a better book, preach a better sermon, or make a better mouse-trap than his neighbour, though he build his house in the wood, the World will make a beaten path to his door."

Mr. Siemens has not treated the subject from this comparative standpoint, and whilst we must thank our President for pointing out the important truth mentioned above, we regret that he has not brought it to its proper conclusion, and the result is, that he does not set forth the true laws that govern cost of production, but leads us into by-paths that hide the truth.

After introducing this subject, we, speaking as electrical producers, had the right to expect an answer to this question : "Is the English electrical industry capable of producing as cheaply or cheaper than its Continental or American rivals ?"

If Mr. Siemens thinks the answer should be in the affirmative, then we would ask "Why are millions worth of electrical machinery imported from abroad ?" If the answer should be in the negative, then we wish to hear from the Presidential chair the reasons and the remedy.

We cannot deduce from Mr. Siemens's address a decided opinion, but from its general pessimistic tone, we must surmise that English industries are not capable of producing that cheapness which he considers essential, and he makes this concluding remark :—"It is hopeless to endeavour to re-establish our former monopoly."

Surely Mr. Siemens said nothing that should lead him to give such desponding advice, and we, as a firm engaged in producing industries, wish to raise a protest against such a melancholy pronouncement, which, if believed in, must inevitably have the effect of striking terror into the hearts of English manufacturers.

Surely a country that, not so long ago, could make "mouse-traps" better than any other country, can hope to do so again ? England has a healthy climate, an unrivalled geographical position, a good soil, great mineral resources, and an industrious population—surely, if we at present do not produce as well and cheaply as other countries, whose natural resources are worse than ours, there must be a reason for it of an exceptional character.

Mr. Siemens somehow endeavours to blame somebody—our workmen and trade unions are accused of restricting output, and thus increasing cost of production—our patent laws and the "want of the metric system" are mentioned.

I hold that these, and similar reasons, are secondary, and would disappear if the primary reason were removed. Cheapness of production nowadays depends upon the manufacture of large quantities, and to enable a large output, the first essential is demand—that is, customers and their orders.

We do not at present manufacture in England as cheaply as our rivals abroad, because our factories are not as large, and our output not as continuous—in other words, our rivals have a larger market for their products. This larger market is given to foreign manufacturers by the help of their and our Governments. Their Government gives them security by means of Customs duties of their home market—our Government gratuitously places at their disposal our own home markets—thus we in England are deprived of that reasonable security, so necessary to ensure large output, and demand which our rivals possess.

It is evident that Mr. Siemens, whilst telling us in dismal language that we have lost the faculty of cheap production, does not give us the true reason, which is lesser demand than that enjoyed by our rivals. It is true that had he come to this very obvious conclusion, he would have had to touch upon the fiscal question—a contingency which he deprecates—but the question of cost of production is so intimately connected with the trading systems of the world, that it would have been better not to dwell on the subject at all, than to be diffident in attacking its logical conclusions.

G. Byng.

London, *November 16th*, 1904.

The Electro-Harmonic Society.

I crave the hospitality of your pages for the purpose of airing a grievance relating to the Electro-Harmonic Society.

The recent rapid growth of the Society is undoubtedly due to the excellence of its concerts, and to the great improvement in the conditions under which they are held. Unfortunately, the large increase in the attendance has resulted in the accommodation even of the King's Hall of the Holborn Restaurant being over-taxed, and on Friday last, the first Ladies' Night of the current season, many members and visitors were compelled to resort to the gallery.

The popularity of the concerts cannot but be regarded with satisfaction by the members, but it is to be regretted that it brings in its train certain drawbacks, to which I wish to draw attention with a view to their removal. Chief of these is the practice of "reserving" seats, a privilege which exists only by the courtesy of the members, and, like all such privileges, is liable to be abused. On the last occasion, several tables were wholly reserved long before the hour for the commencement of the concert, and even at 7.45 most of the best seats were thus appropriated, though the persons who had annexed them were for the most part absent from the room. No one can reasonably object to the custom of reserving one or two seats for friends who are known to be coming, provided that the person who reserves them remains on the spot; but to appropriate a row of seats or a whole table, by posting a scrap of paper, or by tipping a waiter to drive away members and guests (as, to my knowledge, was done last Friday), is, I submit, absolutely improper. I trust that the Executive Committee may see their way, in the interests of harmony, to put an end to this objectionable practice.

The abuse above mentioned has grown, perhaps, from a tendency to regard the Ladies' Nights as specially cheap entertainments to which a number of non-members may be invited, the cost of extra tickets on these occasions being only 1s. each, a merely nominal sum. It should not be forgotten, however, that the concerts of the Electro-Harmonic Society are not public, but private functions, and are not proper occasions for the giving of parties to non-members. The extra tickets, in fact, are much too cheap. I venture to suggest to the Executive Committee, therefore, that the price of the tickets might with advantage be made the same as on ordinary occasions—namely, half-a-crown.

Arthur H. Allen.

West Norwood, *November 14th*, 1904.

Exhaust Silencer.

In reply to the inquiry from Mr. H. Willoughby Lance in your issue of the 11th inst. as to the cheapest means of silencing the exhaust from a steam engine of 150-H.P., I would recommend the use of condensing plant, provided, of course, sufficient water is available for the purpose. This would not only do away with the noise, but would also prevent any possible nuisance from steam, and at the same time increase the power of the engine, or allow it to do the same work as at present on 20 per cent. less fuel. Besides all this the life of the boiler would be prolonged by the use of pure warm feed from the condenser, if of the surface type.

The total cost of a suitable surface condenser with Edwards air pump, centrifugal circulating pump, and piping complete, if the condenser is placed fairly close to the engine, would not exceed £280 erected complete at Llandudno.

F. A. Yerbury.

Kingston-on-Thames,
November 12th, 1904.

The Richmond (Surrey) Guardians and German Telephones.

The letter of "Puzzled," in the ELECTRICAL REVIEW of November 11th, raises a question of great importance to the welfare of the country.

It is remarkable that the municipal authorities do not take up a more patriotic position with regard to the placing of contracts for machinery. German and American engines, pumps, valves, and instruments are often specified and ordered by municipalities, when goods equally good and cheap can be supplied of British make.

Most municipalities impose conditions in their contracts with British manufacturers which cannot be imposed on the foreign manufacturer, and the cost of manufacture is sometimes increased owing to the imposition of these restrictions.

It is very surprising that any member of a municipal body will vote under any conditions whatever for the placing of a contract for the supply of foreign-made machinery. I know of municipal works which have a considerable quantity of foreign-made machinery, for which the British manufacturer has never been invited to tender. It is unfortunate that, generally, the members of a municipal body are ignorant of machinery, but if they were as careful in placing contracts for machinery as they are in placing tailoring or printing contracts, then there would be very little foreign machinery imported for municipal purposes.

The labour and trade unionist members of municipalities insist on clauses regarding wages and hours of labour being inserted in contracts—their object being to find work for more workmen. Why do they not vote for a clause prohibiting entirely the supply of goods of foreign manufacture? This would have far more effect in the direction desired.

The "unemployed" question becomes more difficult to deal with every year. Are not the municipalities themselves much to blame for the bad condition of trade and employment, by their great expenditure in unnecessary undertakings, in increasing the burdens which both manufacturers and consumers have to bear? In the few cases when foreign-made goods are cheaper, and I believe there are only very few, would it not be good policy for a town to pay a little more for British-made goods, and cut down, by an equivalent amount, its expenditure on unnecessary undertakings?

Electors should give this question the attention it deserves, and at election times impress on candidates its importance.

Lancastrian.

Employment Bureau.

I think your correspondent's idea of an employment bureau for really qualified members of the I.E.E. an excellent one, and that it would pay its way.

Also I wish you to voice this growl of a country member, viz., that we pay the full subscription (and, on present salaries, can't afford it), and cannot attend the meeting or get any privileges except that of putting I.E.E. after our names and getting the *Journal*.

Also I wish to protest against the methods of examining the qualifications of intending members, as at present it is quite easy for anybody to be elected, provided he can get a few signatures, and, personally, I know many members who have not the slightest qualifications; in fact, one of them, a prominent gas engineer, is a full-blown member.

Growler.

Electrical Engineers and Christmas Boxes.

Judging from the correspondence in your paper, electrical engineers are a mighty bad lot. I see the latest trouble is Christmas boxes. Is it suggested that a man in a good position, or a bad one for that matter, can be bought for the price of 50 smokes, or that a brace of birds will tell him where to place his order? If he drops one firm and deals with another, he will still get a present (if he's cute and splits his order, he'll get two or three). He doesn't ask for the gift, and it will take more than hearsay evidence to make me believe that he makes out a specification for it with a penalty for non-delivery. The whole thing is merely a matter of courtesy between buyer and seller, too trivial both in its object and its result to call for suppression.

Illegal commissions are quite another thing. All that can be said about the practice is that it *is* illegal, and until someone pretty high up gets his tail salted, things will remain about the same.

As to the electrical profession being worse than any other, it has been said that a doctor will recommend a particular chemist, that a lawyer will run an insurance agency, while even the parson expects his "Easter Offering" (and generally gets it).

Goth.

[Our correspondent asks whether a Christmas box will influence the placing of an order, and himself answers the question in the affirmative. "If he's cute and splits his order, he'll get two or three." The transaction is emphatically not one between buyer and seller, but between the buyer's *agent* and the seller—a fundamental difference.—EDS E R.]

Lead-Covered Wires.

In reply to Messrs. Cowtan & Son's electrician, it may be interesting for him to know that we have had some experience with testing out and rectifying defective underground

lead-covered cables, in which similar brick boxes had been constructed, and we found that the screw joints in the barrel were not sound, and the brick boxes, although covered with an inspection cover, were found to be defectively built; the surface water percolated through the brick courses, and also through the cover, this not being properly sealed in its position.

We may add that if careful and experienced electricians had run the wires, taking them carefully through the pipes, by using an insulated mouthpiece, so as to prevent damaging the lead cover in drawing in the wires, he would probably find that the insulation resistance would be up to its standard for a considerable period after its installation.

P. Y. C.

I can quite sympathise with Mr. Bands and his experience with lead-covered cables, and I would state that to my knowledge he is one of many who have a grievance, rightly or wrongly, against this class of conductor. Now, I find that good quality lead-covered cables are often unjustly condemned for faults, which in most cases might be traceable to insufficient precaution being taken when installing.

I am not acquainted with the details of Mr. Bands' installation, and therefore have to assume certain conditions. It would appear from the information given that the faults he mentions are due to electrolysis. Now lead-covered cables, drawn into ducts with the lead sheathing cut into at the manholes and with a fair quantity of moisture, fulfil the very conditions for vigorous electrolytic action.

Mr. Bands makes no mention as to how the joints and ends of his cables are sealed. This matter is most important with lead-covered cables, and, if neglected, causes no end of trouble. If his joints and cable ends are simply taped up, the sooner this practice is abandoned, the better. What is required is that wherever the lead sheathing is broken for jointing or any other purpose, it should again be hermetically sealed by means of joint or end boxes filled in with compound.

The writer has had experiences similar to those of Mr. Bands, and has invariably traced such faults to electrolysis and friction. He has to-day miles of lead-covered cables working under similar conditions to those described by Mr. Bands, which are doing good work with absolutely no trouble.

This he attributes wholly to the fact that they are carefully sealed throughout their entire length, and thus guarded against electrolytic action.

A. H. M.

DIRECT OR COMBINED REPRESENTATION: A QUESTION FOR BRITISH MANUFACTURERS.

By T. W. SHEFFIELD, A.M.I.E.E.

It is highly interesting to note the Leader in the Electrical Review for November 11th, dealing with the commercial side of engineering, and I venture to suggest that this question is one of paramount interest to all manufacturers and firms who have the responsibility of conducting and *increasing* their productions, in the face of the ever-growing foreign competition in our home and colonial markets. In connection with this, it is important to note that British Consular reports upon trade often make reference to the fact that British representation is not in such evidence as it should be where sound business could be secured for the home firms. The cause is not far to seek, if we take into consideration the enterprise of America and Germany in securing the amount of business they do from our Colonies, and there is no excuse here that the British representative is unacquainted with the language or unfamiliar with the methods of the people from whom he seeks to obtain business. It is therefore inconceivable that British manufacturers are indifferent to the expansion of their business, as we know quite certainly that it is not due to an excess of orders for the home market; and there are few trades where the sales equal the possibilities of output, and fewer still that could not increase their power of production if the demand were greater.

The main reason why so few British representatives visit our Colonial markets is that the cost is too great for the smaller firms to bear; it therefore becomes necessary for these firms to bear a proportion of the expenses with several other firms manufacturing different specialities for the Colonial markets. This would mean breaking down the conservatism of individual firms, which has so long retarded business expansion abroad; but this is a small matter compared with the increased turnover which could be secured. As an illustration, let us assume that there are 250 firms engaged in Colonial trade, and that their average turnover is £100,000, or £25,000,000 in all. Next let us assume that there are 25 Colonial markets, and that it is desirable for each of the 250 firms to be directly represented. One representative may cover five markets during the year at the cost of £1,000; each firm would, therefore, require five representatives at an aggregate cost of £5,000, which is equal to 5 per cent. upon the total turnover. We may assume that 25 per cent. of the total turnover comes direct, and, therefore, their actual turnover is burdened with $6\frac{2}{3}$ per cent. The businesses, with the keen competition now existing, are few indeed which can bear such a charge, and still leave a minimum amount of clear profit

In comparison with the above, we will take the American system. The 250 separate firms become 10 combines averaging 25 firms each. They cover the same markets, but as the same number of representatives do business for a group as cheaply as they would serve a single firm, the expenditure of £10,000 is taken from £2,500,000, instead of from £100,000. The outlay is thus reduced from £2 10s. to 2s. per £50 of turnover, *i.e.*:—

250 firms spending £5,000 each equals ... £1,250,000;
10 combines spending £5,000 each equals £50,000.

In connection with the foregoing, it may be interesting to reproduce a circular I sent out to British manufacturers in 1896, previous to my going out to South Africa.

To English Manufacturers.

Does Direct Representation Pay?

It is an appalling fact "that many English manufacturers, whose goods are suitable and to a large extent in demand for consumption in the South African colonies, take up a position that their profits yield so small a margin that they cannot afford to employ a direct representative, or to go to any expense to make their goods known. The matter, therefore, to those who take up this position, is one of, 'Does direct representation pay or not?' That direct representation does pay 'is proved by the evidence of leading papers and firms,' and also that it is always productive of opening up business that more than repays the expense of the outlay. Buyers will place orders with the firms' representative that would never be secured by letter or otherwise; besides having a direct representative, it gives the firm an invaluable knowledge of the many requirements of the market, which facilitates future business. 'Manufacturers have therefore to take into consideration the unlimited field there is for English manufactured goods of all descriptions in the Colonies, and our ever-extending British Empire, South Africa.' The only thing that now remains is for manufacturers to balance the matter in their own minds; whether to make the venture of being represented directly, which approved example has shown will bring them unlimited monetary returns, and will stem the tide of orders going abroad which could be supplied by our own manufacturers, if they are prepared to be represented directly, or abstain altogether and confine their attention to the narrow bounds of the keenly contested 'home trade,' with its ever-increasing foreign competition."

In conjunction with this, it is of interest to note the last Board of Trade returns of the imports of electrical machinery into Natal, which, from personal observation, is one of the most eminently British colonies we have. The imports from America of electrical machinery were worth £6,000 for last year, and £5,000 from Germany, *i.e.*, £11,000 worth of electrical goods.

There is no doubt that these imports would have been far in excess of this amount were it not for the many interests in common with the home country; in fact, I can say, without fear of contradiction, that of all the Colonies I have seen, my observations convince me that Natal is deserving of the highest praise in view of its adherence to goods of British manufacture, in preference to any other, and British manufacturers should see that this sentiment is not neglected or abused.

Finally, can we afford to let foreign competitors overthrow our Colonial markets with qualified commercial representa-

tives, while we mainly depend upon orders sent without tactful solicitation? These orders have hitherto been secured mainly through national sentiment; but the old order has changed, and our Colonial brothers are buying in the world's market. It, therefore, becomes a question whether our comparatively small firms can bear the cost of separate representatives. The answer in each case is obviously in the negative. This being so, is there a better way of dealing with the difficulty than the title of this brief article suggests? If so, the views of manufacturers would be interesting, and would command the attention of all interested in the expansion of the Colonial markets.

BUSINESS NOTES.

Electrical Wares Exported.

Week ending November 17th, 1903.

Adelaide	Value £22
Alexandria	176
Amsterdam	35
Brisbane	12
Buenos Ayres	215
Calcutta	285
Colombo	70
Durban	262
East London	440
Flushing	72
Fremantle	189
Gibraltar. Teleg. cable ..	742
Hamburg. Teleg. mat. ..	326
Hong Kong	38
Madras	57
Melbourne	62
,, Teleg. cable ..	630
Otago	22
Penang	572
Port Elizabeth	24
St. Petersburg. Teleg. wire ..	108
Shanghai	26
Singapore	34
Stockholm. Teleg. wire ..	135
Sydney	167
,, Teleg. mat.	32
Tientsin	85
Trinidad	40
Wellington	1,152
Yokohama	41
Total ..	£6,071

Week ending November 15th, 1904.

Adelaide	Value £18
Alexandria	513
Amsterdam	883
,, Teleg. wire ..	142
Bangkok. Elec. machinery ..	228
Barcelona	15
Batavia	628
Beira. Teleg. mat.	105
Bombay	277
,, Elec. machinery ..	117
,, Teleg. mat.	61
Buenos Ayres	262
,, Teleg. appar. ..	300
,, Teleg. mat. ..	100
Calcutta	700
,, Elec. machinery ..	1,973
,, Teleg. mat.	340
Cape Town	273
,, Elec. machinery ..	55
Colombo	317
,, Elec. machinery ..	31
Delagoa Bay	18
Durban	544
,, Elec. machinery ..	171
Flushing	20
Fremantle. Elec. machinery ..	200
Gibraltar	8
Hong Kong	7
Lyttelton	110
Madras	64
Melbourne	170
,, Elec. machinery ..	40
Mombasa. Teleph. appar. ..	114
,, Teleg. mat. ..	656
Montreal	80
Nagasaki. Elec. lighting wire	862
Otago	45
Paris	12
Penang	29
,, Teleg. mat.	319
Perth	555
,, Elec. machinery ..	14
Port Elizabeth	183
,, Teleg. mat. ..	2,090
Port Said	15
Rangoon	907
Rio Janeiro	18
Rosario	161
Rotterdam	47
St. John's, N.B.	16
St. Petersburg	10
,, Teleg. mat. ..	120
Santos	127
Shanghai	592
,, Elec. machinery ..	128
Singapore	59
,, Teleg. mat.	93
Stockholm	39
Suez	12
Sydney	1,741
,, Elec. crane	1,058
,, Teleg. mat.	60
Wellington	54
Yokohama	1,228
Zanzibar	29
Total ..	£20,053

Foreign Goods Transhipped.

Sydney. Elec. lamps ..	Value £22

Barbadoes. Elec. goods	Value £16
Boulogne. Elec. goods ..	20
Durban. Elec. goods	28
,, Elec. apparatus ..	48
Total	£112

To Manufacturers.—The Westminster Electric Supply Corporation, Ltd., has just sent to manufacturers of electric current-consuming apparatus (other than incandescent lamps and fittings) a circular letter with regard to advertisements. We are asked to say that any manufacturer (not agents) who has not received a copy of the letter, can have the same by applying to Mr. L. H. Hordern, the manager of the company, at Eccleston Place, S.W.

Buffalo Raw-hide Gearing.—Messrs. W. F. Dixon and Co., of C-on-M, Manchester, forward us particulars of their well-known raw-hide silent gears, which have proved so successful in operation during the last few years. On the many situations where this class of gear is, or should be, the only one admissible, it is needless to enlarge, but it is interesting to note that the firm's experience includes several instances where pinions have been running 140 hours per week at 800 or 900 revolutions, transmitting some 40 B.H.P. for periods of four and five years—in the most trying situations, and without undue wear.

Markt's Patent Auto-Claw Switch.—Messrs. Markt Bros. & Co., of Beech Street, E.C., have introduced a decidedly novel and compact little switch of tumbler type, in which the arrangement allows of $\frac{3}{4}$ in. between the two terminals. In order to ensure efficient insulation after switching off, two china claws are

arranged to automatically enclose all the current-carrying portions connected to the handle, leaving the terminals perfectly isolated. The contact maker has a horizontal sliding motion, and that and the terminals are also isolated from the cover by a mica shield. The switch is well constructed, the action, it is claimed, being easy and reliable; it is provided with plain or ornamental brass and china covers. The firm have arranged to supply the trade with specially constructed small sample boxes containing a full range of the different styles of the above switch.

Installation Contracts.—The following is a list of contracts which have lately been received by Messrs. G. H. Woods, Slacke & Co., of Blackburn:—

Abergavenny.—Complete plant, consisting of engines, dynamos, motors steam piping and accumulators (the latter of Messrs. Pritchetts & Gold's make).

York (City Asylum).—Complete electric lighting, about 1,700 lights, including boilers, feed pumps, steam and exhaust piping, three engines and dynamos, main switchboard, motors, &c.

York.—Electric light installation for City Cattle Market.

Salford.—Complete electric lighting, including switchboards, arc lamps, &c., for half a mile of transit sheds for the Manchester Ship Canal Co.

Newcastle-upon-Tyne.—Complete electric lighting, including switchboards, &c., for the new Hospital, Union Workhouse.

Rochdale.—Electric lighting of car-shed, including telephones, bells, &c.

Crewe.—Electric lighting of Post Office.

Messrs. Parker, Ltd., and the Trades Unionists.—At the meeting of the Wolverhampton Town Council last week, reference was again made to the points at issue between local trades unionists and Messrs. Parker, Ltd. The dispute arose—as stated in a previous issue of the Electrical Review—over the wages paid by Messrs. Parker to fitters employed on a Corporation contract. A report had been made by the Town Clerk, the substance of which was that Messrs. Parker, Ltd., had not broken their contract with the Town Council. The Town Clerk said that the contract with the firm and the Corporation offered the Council no remedy, because the law was against the Council. So long as the contract was in the form prescribed by the Town Council, he had no option in the matter but to insert the provision as it existed in Messrs. Parker's contract. He also suggested that if, in the opinion of the Trades Council, any variations or amendments were required in the form of the undertaking, the General Purposes Committee might be asked to revise it. It was ultimately decided to refer the whole question to the General Purposes Committee, with the intention of amending the clause.

Carbide of Calcium.—An order has been issued exempting small quantities of carbide of calcium, when kept under certain conditions, from the operation of the Order in Council of February 26th, 1897.

English Pumps in America.—The St. Louis Exhibition jury have awarded a silver medal to the Pulsometer Engineering Co., Ltd, of Reading (makers of the well-known Pulsometer steam pump) for the "Geryk" vacuum pump, and a bronze medal to the inventor, Mr. H. A. Fleuss. Owing to the high vacuum obtainable from it, this pump is largely used for exhausting incandescent lamps, Röntgen ray tubes and other purposes where a high vacuum is essential. We are pleased to note that the excellence of these British pumps enables them to be sold in the United States, notwithstanding the import duty of 45 per cent.

Imports of Foreign Electrical Apparatus.—A steady tone is noticeable in the imports of foreign electrical goods and apparatus into this country, the returns for October last showing a total of £63,114, as against £63,699 in the preceding month, and £63,661 in October, 1903. For the 10 months ending with October last the imports have attained a value of £629,078, which compares with £649,144 in the corresponding 10 months of last year.

St. Louis Exhibition Awards.—We have already notified in these columns that certain firms have received gold medals in connection with electrical exhibits at the above exhibition. The following is a complete list:—

Group 19.—*Instruments of Precision.*

Grand Prize.—Sir Howard Grubb, F.R.S., the Cambridge Scientific Instrument Co., and the Royal Mint.

Gold Medal.—Thomas Thorp, A. Hilger, W. F. Stanley & Co., Ltd., and Newton & Co.

Silver Medal.—John J. Griffin & Sons, Ltd., the Pulsometer Engineering Co., Ltd., and Aitchison & Co.

Bronze Medal.—C. & E. Layton, & John Davis & Sons, Ltd.

Awards to Collaborators.

Gold Medal.—W. J. Hocking (the Royal Mint).

Bronze Medal.—Henry Fleuss (the Pulsometer Engineering Co., Ltd.).

Group 23.—*Chemical and Pharmaceutical Arts. Awards to Collaborators.*

Gold Medal.—Prof. James Dewar, M.A., LL.D., D.Sc., F.R.S., (Low Temperature Research Exhibit), and Dr. Andrew Ross Garrick (the United Alkali Co., Ltd.).

Silver Medal.—J. E. Petavel (Low Temperature Research Exhibit.).

Department of Machinery.

Group 62.—*Steam Engines.*

Grand Prize.—John Fowler & Co., Leeds, Ltd..

Silver Medal.—John Moncrieff.

Department of Electricity.

Group 68.—*Electro-Chemistry.*

Gold Medal.—United Alkali Co., Ltd.

Silver Medal.—Sherard Cowper-Coles & Co., Ltd.

Awards to Collaborators.

Silver Medal.—Dr. Andrew Ross Garrick (United Alkali Co., Ltd.).

Group 69.—*Electric Lighting.*

Gold Medal.—The Consolidated Electrical Co., Ltd., and George Trollope & Sons.

Group 70.—*Telegraphy and Telephony.*

Grand Prize.—General Post Office, London.

Gold Medal.—The India-rubber, Gutta-percha, and Telegraph Works Co., Ltd., and Muirhead & Co.

Group 71.—*Various Applications of Electricity.*

Grand Prize.—The Cambridge Scientific Instrument Co., Ltd., and Nalder Bros. & Co.

Gold Medal.—Nalder Bros. & Thompson, Ltd., Crompton & Co., Ltd., Everett, Edgcumbe & Co., Robert W. Paul, Newton and Co., Alfred C. Cossor, Elliott Bros., Kelvin & James White, Ltd., and the Synchronome Co.

Silver Medal.—F. Darton & Co.

Awards to Collaborators..

Grand Prize.—Lord Kelvin (for important contributions to electrical engineering).

Gold Medal.—Hugh Langbourne Callendar, F.R.S. (Cambridge Scientific Instrument Co., Ltd.), and William du Bois Duddell, Wh. Sc. (Cambridge Scientific Instrument Co., Ltd.).

Silver Medal.—Robert Stewart Whipple (Cambridge Scientific Instrument Co., Ltd.) and A. C. Heap (Elliott Bros.).

Group 118.—*Metallurgy.*

Grand Prize.—Birmingham Metal and Munitions Co.

Gold Medal.—Sherard Cowper-Coles & Co., Ltd., the Lilleshall Co., Ltd., the Monk Bridge Iron and Steel Co., Ltd., and the Farnley Iron Co., Ltd.

Silver Medal.—The Anglo-French Nickel Co., Ltd., Sheepbridge Coal and Iron Co., Ltd., and United Alkali Co., Ltd.

Bronze Medal.—Joseph W. Lovibond.

Gold Medal.—The Institution of Mining Engineers.

Awards to Collaborators.

Gold Medal.—Bennett H. Brough (the Iron and Steel Institute).

Silver Medal.—M. Walter Brown (the Institution of Mining Engineers).

The C. W. Hunt Co., of West New Brighton, New York, have been successful at the World's Fair, two of their exhibits securing highest awards. The Hunt "Industrial" railway received the gold medal for narrow-gauge railways, and the electric locomotive (storage battery) built by that company received the silver medal, being the highest award for that type of locomotive.

Meeting of Creditors.—A meeting of the trade creditors of Frew, Watson & Co., Ltd., gas-fitters and electrical engineers, was held at Perth on 7th inst., and a committee has been appointed to act with the liquidators.

Direct-Reading Meters.—Mr. G. Braulik, of 217 and 218, Upper Thames Street, E.C., writes, with reference to the disputes at Aston in connection with meter registration, that the method of registering in the "Eclipse" meters is specially designed to prevent the possibility of disputes in connection with meter readings, as the energy consumed is recorded direct on the dial in plain figures, in B. of T. units, and can be read with equal ease by the consumer as well as the meter reader.

Criton Water Softener.—We have received from the Pulsometer Co., of Reading, a new catalogue of the Criton water softener, one of that rather numerous class of apparatus which would be very much more widely employed if engineers and steam users would learn how much cheaper it is to remove lime salts from water than to spend time and labour in burning extra coal to combat the heat-retarding effect of scale, in chipping off the scale when this becomes thick, and in ruining the plate surfaces by such chipping and damaging the boiler by the stresses and over-heating caused by scale. All water softeners act very much on one principle, but we must congratulate the Pulsometer Co. on the graphic method of showing the exchanges which take place in the various reactions of the chemicals employed. So far as regards London and the South of England, as a rule carbonate of lime is the chief salt to be removed, and cheap caustic lime is the chemical to employ to secure the Clark effect. Yet how rare, comparatively, is the engineer who gives thorough attention to this important subject.

The Lowne Atmospheric Engine.—A correspondent writes pointing out that this engine, to which we referred in our last issue, is by no means a new invention; it was first devised by Mr. R. M. Lowne, of Catford, S.E., about 12 years ago, and improved five years later. Some hundreds were made by the inventor before the patent rights were transferred to Messrs. Hardy and Padmore.

Water Coolers.—Messrs. H. and E. Albert, who, we understand, were the first firm in this country to adopt this method of cooling, by putting in a plant for their mills at Messrs. Bolckow, Vaughan & Co.'s works, have just placed an order with Mr. E. F. Jarvis, of Middlesbrough, for a plant to be erected at their mills at the Earl of Dudley's Round Oak Works. Mr. Jarvis will forward his pamphlet on water cooling, which illustrates and describes an improved and patented form of water cooler, on application.

A Hackney Club Concert.—The second annual distribution of prizes and smoking concert of the Hackney Council Amateur Rowing and Swimming Club is to be held at the King's Hall, Hackney Public Baths, Lower Clapton Road, on Thursday evening, December 1st.

Catalogues and Lists.—Messrs. John Davis & Son (Derby), Ltd., have sent us a copy of their latest catalogue relating to electric mining work. Coal-cutting receives very prominent attention, descriptions being given of all classes of machinery to suit longwall or pillar and stall systems. The book, which is finely illustrated, contains views of high-speed engines, generators and motors, starting switches, switchboards, haulage gear, electric drills, testing sets, damp-proof fittings, protecting fittings for lamps, water alarums, mining bells, hand lamps, telephone systems, and a variety of other things required for the electrical equipment of a modern mine. The catalogue has come out just at the right moment, and should be serviceable to mine managers. The firm has published a list of questions to be answered by those who wish electrical schemes to be placed before them for any particular mine.

An illustrated leaflet relating to the new "Sperrynwood" patent tumbler switches has been issued by Messrs. Sperryn & Co., Ltd, of Birmingham.

The Electrical Co., Ltd., have issued a new leaflet (No. 101) giving prices of their "Luna" carbons for open-type lamps.

Mr. L. Schuler, of 138, Southwark Street, S.E, has sent us a copy of his pamphlet describing, in a very detailed manner, his patent hydraulic drawing presses.

The British Thomson-Houston Co., Ltd., is issuing a useful and attractively got-up little pamphlet, giving hints to users of electric light on the best means of securing maximum light at minimum cost.

A second edition of their polyphase motor catalogue has been published by Messrs. Mather & Platt, Ltd., of Manchester. Tabulated data respecting motors with short-circuited or squirrel-cage rotors are given, also particulars of weights and dimensions.

From Messrs. J. H. Holmes & Co., of Newcastle-on-Tyne, we have received copies of two new circulars; one relates to the "Holmes-Page" patent quick-break chopper type switches, of which full particulars and prices are given, also excellent half-tone illustrations of complete switches and parts. The other particularises the firm's patent recording instruments; one of the illustrations in this list shows the details of the mechanism, and another shows the method of inserting the paper roll.

"The Power of the New York Subway" is the title of a new publication which has reached us from the Allis-Chalmers Co., of Milwaukee. It describes and illustrates in very fine style the power station equipment for this subway, which includes a large number of Allis-Chalmers engines.

The Brush Electrical Engineering Co., Ltd, in their "Brush Bulletin," No. 9, which has just been issued, give, in their accustomed first-class style, particulars and photographic illustrations of their latest practice in induction motors. The "Bulletin" will form a fit companion for the others already published by the company. The pictures which, as usual, are faultless, show motors with short-circuited rotor, and with wound rotor and slip rings, a view of the pulley-end of a D.S. motor, separate illustrations of stators and rotors, also starters. Particulars as to dimensions, weights, prices and code words are conveniently tabulated.

For Sale.—Messrs. P. Huddleston & Co. will, on Nov. 24th, sell a quantity of electrical apparatus and fittings at Manchester. Some particulars appear among our advertisements to-day.

What is a Street?—We understand that the London County Council recently summoned Mr. Heathman, the ladder-maker, of Parson's Green, for forming a street without sanction, and

the magistrate decided in favour of Mr. Heathman with £5 5s. costs against the L.C.C. Mr. Heathman has erected some new buildings to enlarge his factory upon his own freehold land at the side of his own freehold private roadway, and the L.C.C. contended that private roads were not permissible, although Mr. Heathman has his own gateway which is closed every night. The Council is not satisfied with the magistrate's decision, and has got an appeal set down at the King's Bench Division of the High Court for the 22nd inst. The question is one of great importance to those who may contemplate erecting new factories or enlarging old ones on land previously not built upon.

Book Notices.—"Elements of the Mathematical Theory of Electricity and Magnetism." By J. J. Thomson, D.Sc., F.R.S., &c. Third Edition. London: C. S. Clay & Sons and the Cambridge University Press. 10s.

"The American Institute of Architects' Quarterly Bulletin." July, 1904, Vol. V., No. 2; and "Proceedings of the Thirty-seventh Annual Convention of the American Institute of Architects." Held at Cleveland, O., October, 1903. Washington, U.S.A.: The Board of Directors, A.I.A.

"Annual Report of the Commissioner of Patents for the U.S. for the Year 1903." Washington, U.S.A.

"Electricity: its Place and Power in the Universe; or, a Justification of the Single Theory of Electricity and Magnetism." Glasgow: Wm. Hodge & Co. 1s.

"How to Build a Petrol Motor." By James F. Gill. London: Dawbarn & Ward, Ltd. 6d. net.

Our well-known contemporary the *Tramway and Railway World*, has issued an interesting sheet of tramway returns for the past year, which will doubtless prove of value to engineers and others who seek for information on this subject.

"X-Rays: their Employment in Cancer and other Diseases." By Richard J. Cowen, L.R.C.S.I., &c. London: Henry J. Glaisher. 2s. 6d. net.

The *Official Circular* of the Tramways and Light Railways Association for November, contains the full copy of Mr. A. N. Connett's paper on "Notes on Permanent Way for Tramways," also a report of the discussion on the paper read by Mr. J. I. Hall on "Raworth's System of Automatic Regenerative Control for Electric Traction."

"The Physical Review." Conducted with the Co-operation of the American Physical Society. Vol. XIX., No. 5, November, 1904. Lancaster, Pa., New York and London: The Macmillan Co.

Trade Announcements.—We understand that an amalgamation has been effected between two of the largest electrical concerns in the Eastern Counties, namely, Messrs. G. N. C. Mann and Co., of Norwich and Lowestoft, and Messrs. Hall & Hackblock, of Ipswich. The Ipswich business will still be carried on under the name of Hall & Hackblock as heretofore, and will be under the personal supervision of Mr. James Hall. We learn that both firms are very busy in the various departments, more especially in country house installations, of which each has in hand a considerable number both in the Eastern Counties and in other parts of the United Kingdom.

Dissolutions and Liquidations.—A meeting of the Rapid Transit Co., Ltd., is to be held at 8, Broad Street Avenue, E.C., on December 12th, to hear an account of the winding up from the liquidator, Mr. G. H. Homan.

The Direct-Action Engine Syndicate is winding up voluntarily with Mr. O. P. Macfarlane, 138, Leadenhall Street, E.C., as liquidator.

Messrs. B. Reid and A. Fishlock (Reid & Fishlock, electrical engineers, 2A, Maryland Street, Liverpool) have dissolved partnership. Mr. Fishlock will attend to debts, and continue the business under the old style.

Bankruptcy Proceedings.—In the Glasgow Sheriff Court on Wednesday, the 9th, a petition for cessio was presented by the National Telephone Co. against James Gray, electrical engineer, 19, Waterloo Street, Glasgow. In reply to Mr. Andrew, writer, for the petitioners, Gray stated that he was 30 years of age, and had been in business in Waterloo Street for four years. His capital at the commencement was £50, which he received as a present from his father. He had a fair measure of trade. He succeeded to a property in Leith, over which there was a bond. He sold the property, and realised £30 net. That was his only interest in his father's estate. Part of the profits of the business went towards building it up. His liabilities were £470 over and above the profits earned. He had not lived extravagantly, and his losses were chiefly to be attributed to loans. Both loans were simply matters of arrangement at the time and were purely business ones. He wished to pay everyone, and if he had got time he would have done so. His brother-in-law did not intend to make a claim for any money he had loaned him. There had been five or six petitions for cessio presented against him during the last 12 months. Within the past few months petitions were presented by McGeoch, Conradty, Baird & Co., and the National Telephone Co. The examination was afterwards closed.

Under the failure of Arthur Edward Brooks, electrical engineer, 110, Cheapside, E.C., trading as Brooks & Brooks, the first meeting of creditors was held on Monday, at the London Bankruptcy Court, before Mr. C. A. Pope, Official Receiver. Mr. A. J. Benjamin attended for the petitioning creditor, and Mr. A. D. Levi for the debtor. A statement of affairs was presented, showing total liabilities £5,874 12s. 1d. (unsecured, £2,327 1s. 1d.), and assets valued at £37 15s. The debtor states that in 1901 he entered into partnership with a Mr. S. O. Cook, and they started business as electrical engineers at 110, Cheapside. He (debtor) provided £150 capital and Mr. Cook brought in his connection. The latter withdrew from the firm in 1903, since which time he had traded alone, but under the old style of Brooks & Brooks. The debtor adds that he has also been interested in other businesses, in connection with which he guaranteed liabilities in consideration of receiving a share of the profits. It is to his liability under those guarantees that he attributes his insolvency. In the absence of any offer, the case was left in the hands of the Official Receiver to be wound up in bankruptcy, the debtor's public examination being fixed for November 30th.

LIGHTING AND POWER NOTES.

Andover.—Notice of the application of the Corporation for a prov. order appeared in the *London Gazette* for November 11th.

Ashton-under-Lyne.—The T.C. has fixed the price of energy to power users at 1½d. per unit, if the consumption per quarter exceeds 500 units, and at 1d. per unit if over 1,000 units are used per quarter.

Australia.—The Railway Commissioners are contemplating the adoption of the "Stone" system of electric lighting for the trains.

Brandon.—The North Brancepeth Colliery Co. has offered to supply energy to the U.D.C. for public lighting, for 72 25-C.P. lamps at 42s. 6d. each per annum, or at 37s. 6d. each for lamps of 16 C.P.

Clewer and Old Windsor.—The Windsor Electrical Installation Co., Ltd., is applying for electric lighting powers for these two parishes.—*London Gazette*, November 15th.

Continental Notes.—ITALY.—An electricity works, with a producer gas plant, has just been completed and put into operation at Volterra.

SPAIN.—Application for powers to utilise the water power of the River Segre for electricity purposes has been made.

Conway.—Notice of the Council's application for a prov. order appeared in the *London Gazette* on November 11th.

Dover.—There was no opposition at the L.G.B. inquiry into the application of the T.C. for a loan of £24,475 for electricity purposes. A portion is for free wiring purposes, and the town clerk stated that this work would be done by contractors, and not by the Corporation.

Durham County.—The Electricity Supply Committee, appointed by the C.C. to report upon the attitude of the various district councils towards the suggested County Council electricity supply scheme, states that less than one-fifth of the area is at present covered by existing companies. In a number of cases, districts with large rateable values and populations were only committed to companies for a short term of years. The Committee recommended the engagement of an expert to furnish an approximate estimate of the cost of a county scheme, showing the capital outlay, up-keep and maintenance per annum, and an estimate of the cost per unit to the county. A conference of the local authorities at the Shire Hall was also recommended. The Committee, as might have been anticipated, contended that, by the adoption of such a scheme, the consumers would be supplied "more cheaply." The L.G.B. has written stating that it was not aware that there was statutory authority to enable the C.C. to carry out such a scheme of electricity supply, or incur any expense for such. In view of this communication the report has been referred back.

Eastbourne.—The Corporation is applying for extension powers to Willingdon.—Notice is filed in the *London Gazette* for November 15th.

Felixstowe.—The Felixstowe and Walton U.D.C. on the 11th inst., completed the purchase, under agreement, of the Suffolk Electricity Supply Co.'s works, negotiations with a view to this purchase having been pending five years. Under the agreement the company will still carry on the undertaking, under the Council, for the next 25 years, at the end of which time the Council will take over the entire control without payment to the company. In the meantime, the company are to retain the profits and pay the Council 6 per cent. for all capital monies advanced. This is in payment of interest and sinking fund on the loans borrowed by the Council for the purpose of the purchase, and all additional new works. The purchase price is £8,000, of which £5,000 was paid on 11th inst. The remaining £3,000 is retained until the company can show that the undertaking is paying 6 per cent. The price of energy is to be reduced as from November 15th, from 8d. to 6½d. per unit, but will be increased to 8d. per unit during the three summer months, when, it is stated, the visitors will be looked to, to defray the extra cost. The purchase was completed at the Town Hall between Mr. J. Manning Prentice, the solicitor to the company, and Mr. F. B. Jennings, clerk to the Council, the undertaking being formally handed over to the Council by Mr. P. C. N. Peddar, the chairman of the company, by nailing a brass plate, bearing the Council's name, to the entrance to the works. A luncheon was subsequently given at the instance of the company at the Bath Hotel. Mr. Napier Prentice is engineer to the company, and Mr. R. P. Wilson consulting engineer to the Council.

Kingsbury.—Notice of the application of the U.D.C. for a prov. order appeared in the *London Gazette* on November 11th.

Gorleston.—In regard to a supply of electricity from the Yarmouth Corporation for lighting the town, the electrical engineer to the latter advises that both the high and low-tension systems be installed for the Gorleston and Southtown district. It is suggested that the mains be now all laid underground. A cable is to be laid under the Haven at a depth of 7 ft. from the bed, and the Commissioners have resolved to forbid the dropping of anchors within 50 yds. of the cable. The L.G.B. has sanctioned a loan of £2,000 for this work, and a further sum for carrying out the extension to Gorleston.

Gosport.—The local electric light company is applying for a new prov. order for the district, with 27 of the streets which were included in the original scheme, deleted, it being found that this work could not be carried out. The Council has approved of this. The charge to private consumers for energy has been fixed at 4½d. per unit.

Heckmondwike.—During the half-year ending September 30th last, 159,031 units were sold by the Council's electricity undertaking, as compared with 75,696 units sold in the preceding half-year, and the number of lamps connected was 13,326 as against 9,639.

India.—Major Joly de Lotbiniére's report on the utilisation of the Periyar water-power to supply electricity to Madras has been considered by the Madras Government, and is now before the Government of India.

Jamaica.—The fifteenth annual report and accounts of the Jamaica Electric Light and Power Co., Ltd., show a net profit on the year's working of £1,228; £120 has been written off for bad debts and special charges, and £387 for hurricane damages; £201 was carried to reserve account; £200 to debenture redemption account; £385 to dividend, being 1s. per share, and the balance, £125 carried forward. The net profits for the year are the largest in the history of the company in spite of a fifth reduction in rates, and the directors regret the outlay to repair hurricane damages and provision for reserve to meet the cost of alterations and improvements.

Kilmarnock.—The T.C. electric lighting scheme was inaugurated on the 5th inst. The generating station has been erected at Riverbank, near Riccarton, and will also supply energy to the tramways. It is expected that the cars will commence running on December 10th next. Messrs. Kennedy & Jenkin are consulting engineers to the scheme, and Mr. A. H. Burbidge, formerly with this firm, and under whose superintendence the works have been carried out, has been appointed by the T.C. as its resident engineer and tramways manager.

Litherland.—The U.D.C.'s application for a prov. order was filed in the *London Gazette* on November 11th.

Little Hulton.—The U.D.C. has decided to apply to the Board of Trade for a prov. order for electric lighting.

Llanelly.—The South Wales Electrical Power Distribution Co. intends to deposit a Bill in Parliament at once, to bring the district within the scope of the Carmarthen Power Co. Subject to coming to a satisfactory arrangement, the Council has decided not to offer any opposition.

London.—Westminster.—The Works Committee of the Council, in a report issued on Tuesday, go at length into the negotiations between the Council and the electric light companies with reference to the resolution passed in December, 1902, to prescribe the hours during which the companies shall have access to their distributing boxes. As the various companies have, in the past, made a practice of doing work without notice to, or the consent of the Council, the Committee has instructed the city engineer to keep a register of all boxes and chambers made, or to be made, by each of the electric supply companies, to report particulars of the boxes which have been constructed or enlarged without the consent of the Council; and to report from time to time should a new box be constructed, or an existing box be enlarged without the consent of the Council.

Stoke Newington.—At the meeting of the B.C. on Tuesday, the Electric Lighting Committee presented the following report *re* the electric lighting scheme:—"The publication, in the month of June last, of the Committee's report of the 16th of that month (see Electrical Review, June 24th) led to the reopening of negotiations which have resulted in the modification of the scheme which the Committee previously submitted to the Council, and the Committee now submits the modified scheme for approval. The main outlines of the scheme remain the same. The chief modification which the Committee has sought and obtained is the introduction of a safeguard against any possible loss by the Council during the early years of the working of the undertaking. It has now been arranged that the company supplying the energy shall be paid for such energy the amount of the net revenue which the Council may derive from the undertaking, and that any loss shall be borne by the company. This arrangement may be determined by not less than six months' previous notice, on March 31st, 1909, or any subsequent March 31st, when the scheme outlined in the Committee's report of June last will come into operation, with the following modifications: (1) It is left open to the Council to make an arrangement with the Islington Council for the supply of energy at or near the junction of Blackstock and Seven Sisters Roads, and provisions are made for the continuance of any such arrangement with the Islington Council, similar to the provisions previously made respecting the Council's agreement with the Hackney Council. (2) The minimum period of 12 years, mentioned in the former report as the period before the expiration of which the agreement there detailed could not be determined, will now run from the termination of the modified system. It is part of the scheme that the Council's scale of charges shall be revised, so that, instead of a uniform or flat rate of 5d. per unit for light, consumers shall pay on the maximum demand system at the rate of 7d. per unit for the first hour's daily use of the maximum demand in each quarter, and 2d. per unit for all subsequent consumption; and that in place of the present 3d. per unit for power, there shall be charged 5d. per unit for the first hour's daily use of the maximum demand, and 1d. per unit for all subsequent consumption when the demand does not exceed 20 H.P., with the substitution of 4d. for 5d. when the demand does exceed 20 H.P. Present consumers, however, are to have the option of continuing at present rates. The charge for public lighting is to be 1·45d. per unit for lamps alight during all-night hours, and 1·85d. per unit for those alight during half-night hours. So far as regards the nine arc lamps in High Street and Stoke Newington Road, the total charge is not to exceed the £20 per lamp now payable to the Hackney Council. The scheme outlined in the Committee's report of June is to be proceeded with. Provision is made for the reference to arbitration of disagreements on these points. The company is to bear as part of the expenses of the undertaking the interest and sinking fund or repayment of loan upon the capital outlay involved in the scheme, including the £3,000 already raised, and if the L.C.C. should require a maintenance or reserve fund for repairs or renewals, that also is to be similarly borne, any balance over being returned to the company. When the yearly receipts for energy supplied for lighting exceed 4d. per unit for the total number of units supplied during the year, the excess is to belong to the Council, and similarly any surplus over 3d. per unit for the total number of units supplied during the year for power. In lieu of the recommendations in its report of June last, the Committee recommends (1) the adoption and sealing of a modified agreement with the North Metropolitan Electric Power Supply Co.; (2) the adoption and carrying out of the scheme outlined in this report; (3) the reference to the General Purposes Committee of the acquisition of the sites for the meter and transforming stations; (4) the immediate appointment of the Standing Electric Lighting Committee. At the suggestion of the chairman, the consideration of the report was adjourned to a special meeting of the Council to be held a couple of weeks hence.

Bermondsey.—The electrical engineer reported to the B.C. on Tuesday, that on the 25th ult., at 12.30 p.m., the mains were short-circuited, causing sections of the network to be disconnected from the supply. The faulty sections were speedily located, and an examination revealed pitting of the cable due to electrolysis.

Chelsea.—A committee of the B.C. is to consider a letter from the Chelsea Electricity Supply Co., Ltd., asking to be allowed to submit terms for supplying energy to light the new baths and Town Hall instead of the Council erecting plant, as proposed, to generate their own electricity.

Shoreditch.—At the recent meeting of the B.C., the Electricity Committee reported that during the 12 days the electrical exhibition was open last month in the Pitfield Street Baths, it was visited by 23,460 persons. On the financial side, also, the result was satisfactory, as there was a small surplus after meeting expenses. The report was adopted.

Macclesfield.—The T.C. has informed the B. of T. that the time is not opportune for the Council to undertake an E.L. installation for the borough, and it is anticipated that the prov. order will lapse.

Newport (Mon.).—A L.G.B. inquiry was held recently into the Corporation's application for a loan of £17,825 for electricity purposes. There was slight opposition on behalf of the ratepayers' association.

Oxford.—A building, the ground floor of which is used as a transformer and battery sub-station by the Oxford Electric Co., was damaged by fire recently, necessitating the supply being cut off for a short time. It is stated that the cause of the fire was due to overloading of the cables. The engineer to the company, after several attempts at entering the burning building, succeeded in shutting down the plant. Other arrangements were, however, soon made to continue the supply to consumers.

Penmaenmawr.—The *London Gazette* for November 11th contained notice of the application of the U.D.C. for a prov. order.

Pollokshaws.—Terms have been agreed to, between the burgh and the T.C. of Glasgow, with regard to the supply of electricity. If the burgh obtain from the B. of T. a prov. order, with a clause authorising the transference of the order to Glasgow, the latter will pay the expenses up to £400; if the order is obtained without this clause, Glasgow will only pay expenses up to £200; and if the order is granted, and the work carried out by the burgh themselves, or transferred to a body other than Glasgow, no contribution will be made by the latter for expenses.

Preesall.—Mr. O. Hansom, of Fleetwood, has informed the U.D.C. that it is proposed to form a company to supply energy in the Over Wyre district, and to offer to supply the Council at 4d. per B. of T. unit. The offer is being considered by a committee.

Prestwich.—The U.D.C. has received from the Salford T.C. an intimation that the L.G.B. has sanctioned a loan of £5,000 for the purpose of supplying electric light to the Prestwich district. It is hoped to commence the supply in December.

Retford.—Mr. A. B. Mountain, who was engaged by the Corporation to report upon an E.L. scheme for the borough, states that he is convinced that if a supply of electricity were available, there would be a good demand, and he advocates the adoption of a municipal supply. It is proposed to adopt the low-pressure D.C. three-wire system at 440 volts across the outers. The capacity of the plant to be installed is put at 400 H.P. Mr. Mountain estimates the costs at £14,000 for a steam-driven plant, and £10,000 for a gas-driven one, and advises the Corporation to adopt the latter in connection with its gas undertaking.

Southall—Norwood.—The U.D.C. is applying for a prov. order, and notice is filed in the *London Gazette* for November 15th.

Swinton and Pendlebury.—The U.D.C. has sealed an agreement with the Lancashire Electric Power Co. for the supply of electricity to the district. The company undertakes to meet the cost of obtaining the E.L. order, and to supply energy at not exceeding 7d. and 4d. per unit for lighting, and 4d. and 1½d. for power, to undertake free wiring at 4d. per lamp per quarter, and public lighting at 2½d. per unit. The Council is to have the option of purchasing the undertaking at the end of seven years for 15 per cent. in addition to the total cost; at the end of 10 years for 10 per cent.; and at the end of 14, or any succeeding year, on payment of any sums due to the company for extensions.

Tonyrefail.—The electric plant, installed by a private company, was inaugurated on the 4th inst. A supply to Gilfach Goch is also included in the scheme.

Tunstall.—The U.D.C. has decided to support the application of Burslem T.C. for a prov. order enabling that Corporation to supply energy direct to consumers in Tunstall, subject to the order containing a clause providing for the purchase of the Tunstall undertaking by the U.D.C. on giving six months' notice at any time.

Waterford.—The Corporation has allowed its electric light prov. order to lapse.

Weybridge and Walton-upon-Thames.—Application is being made in the ensuing Parliamentary session by the Urban Electric Supply Co., Ltd, for electric lighting powers. The notice appeared in the *London Gazette* on November 15th.

TRAMWAY AND RAILWAY NOTES.

Aberdare.—Notice of the application of the U.D.C. for electric tramway powers, for the erection of electricity works and refuse destructor, &c., appeared in the *London Gazette* on November 11th.

Accrington.—The Corporation has filed in the *London Gazette* for November 15th, notice of its application to Parliament for electric tramway powers.

Ashton-under-Lyne.—The T.C. has applied to the B. of T. for sanction to borrow £30,000 for the purchase of the undertaking of the Manchester Carriage and Tramways Co., Ltd., within the borough.

Audenshaw.—The U.D.C. has applied to the B. of T. for an extension of a year in which to complete the electric tramways authorised by the order of 1899.

Baker Street and Waterloo Railway.—The London Furnishing Co., who claimed £8,800 for their premises, &c., at 72, London Road, have been awarded £3,500. The railway company's sealed offer was for £3,865.

Belfast.—At the Tramways and Electricity Committee on the 14th inst., a letter was read from the B. of T. approving of the electrification of the tramways. Mr. Acheson Ferguson was selected for the appointment of quantity surveyor for the new generating station. The Corporation intends to adhere to the contract system for the conversion of the lines.

Birmingham and District.—The Corporation has decided to order additional cars with covered tops, the trial one proving very successful. A trial run was made by the company on the Dudley Road—Bearwood section of the trams early on the morning of 13th inst.

The Aston Corporation is now running new electric tramcars to Gravelly Hill and Witton.

Darlington.—A statement dealing with the revenue and expenses of the system was recently submitted to the Committee by the general manager. It appeared that at the end of September the tramways had made a gross profit on working of £1,102 12s. This sum goes to providing interest and redemption due on September 30th, which amounts to £2 088 5s., leaving an actual loss of £985 13s. Practically no repairs have been made, the service being entirely new. The working expenses of the trams from the commencement of running to September 30th were £2,595, and the receipts were £3,698. The number of passengers carried was 908,664, and the receipts per car-mile were 7·249d. The estimated income from the trams and advertising on the cars for the six months ending March, 1905, is £5,055, and the working expenses are estimated at £4,000, leaving a gross profit of £1,055. This will go towards interest and redemption, which require a sum of £1,942, leaving an estimated loss of £887 for that half-year. The loss for the year ending March 31st, 1905, is now estimated to be £2,112. The capital expenditure to date is £60,500, and loans have been borrowed amounting to £64,925. The question of reducing the car service on some of the lines is under consideration.

Derby.—At the last meeting of the T.C. a long discussion took place with regard to the electric trams, and the Mayor pointed out that there was still a balance of £29,500 owing in respect of money borrowed to buy out the Derby Tramways Co. He estimated the receipts from the electric cars to be £28,000 per annum, and calculating the operating charges at 70 per cent., there would be a surplus of £8,500. Out of this had to be deducted interest and sinking fund, amounting to £7,000, leaving a profit of £1,500 per annum. Alderman Spriggs, J.P., the chairman of the Tramways Committee, said he had grave doubts as to whether the profits would be as much, but he hoped there would be such a margin. During the 15 weeks the cars had been running, the receipts had averaged £649 per week, and the working expenses were, of course, considerable. He subsequently proposed that £3,470 be granted for the extension of the electrical tramways from St. Peter's Street to the Market Place, and that the contract with Messrs. J. G. White & Co. Ltd., be sealed. The Committee, he said, desired to complete the Kedleston Road route at once, but they had been advised that this was not the right time to proceed, owing to the unsettled state of the borough finances. Sir Henry Bemrose, in the course of the discussion, objected to one portion of the town being supplied with an electric tram service, and the other half shut off from its benefits, and urged the carrying out of the entire scheme, as first suggested. It was pointed out that the cost worked out to £11,000 per mile.

Germany.—As in previous years, the *Elektrotechnische Zeitschrift* has recently published statistics regarding the development of electric railways and tramways in Germany up to October 1st, 1903. From these statistics we take the following figures, which indicate the progress realized between September 30th, 1902, and October 1st, 1903:—

	October 1st. 1902.	October 1st. 1903.	Increase over 1902.
Central stations for electric tramways and railways, No.	125	134	7·2 per cent.
Length of track, km.	3,388	3,692	9·0 "
Length of roadways, km.	5,151	5,500	6·8 "
Auto-motor carriages, No.	8,365	8,702	4·0 "
Output of electric machines, KW.	120,776	133,151	11·4 "
Output of accumulators utilised, KW.	30,052	38,736	28·6 "

Glasgow.—A proposal that the Tramways Committee of the T.C. consider and report as to the propriety and utility of granting a free pass over the tramway systems to members of the Corporation has been defeated.

The town clerk has reported to the Tramways Committee that there is no provision in the Glasgow Tramways Acts authorising the Corporation to carry and charge for parcels (other than a restricted amount of personal luggage which may be carried free) by the tramways. He explained, however, that in the Clydebank Tramways Order, the powers of which were transferred to the Corporation, there was provision for carrying parcels on the tramways. The matter has been remitted to the general manager for report.

In a report to the T.C., Mr. John Young, late general manager of the tramways, stated that for some considerable time he had been experimenting with various types of top covers. His endeavour had been to design a covered car which, while meeting the comfort and convenience of the passengers, would be as pleasing to the eye as possible. The Committee had on several occasions an opportunity of inspecting the different styles of top-covered cars, and the suggested improvements which members had made from time to time had been practically given effect to. He thought that now in car No. 818 they had a design of top-covered car which met all the requirements of passengers, and at the same time presented an artistic appearance. The car was seated for 32 passengers under the top-cover, and there was also seating accommodation for five passengers at either end for those who might prefer to sit in the open. This, with 24 inside passengers below, gave a total seating capacity of 66. He suggested that this type be adopted for 100 standard cars now authorised to be covered, and also for 100 new cars authorised. When the report came before the T.C., Mr. Alexander, the convener of the Committee, moved its adoption, ordering 200 top-covered cars as proposed. Mr. D. M. Stevenson thought that before proceeding with the construction of the cars they ought to see that they got the most modern type of car. He had recently been in London, where he had seen very smart cars, and they were all double bogie cars, which had an advantage over the Glasgow cars, in respect that there was almost no oscillation. Mr. W. F. Anderson said he had always protested that the existing life-guards were ineffective, and he was told by Mr. Young that because of the oscillation of the cars they could not be kept sufficiently low down. If the double bogie car would prevent oscillation, then that was a strong argument in favour of that form of construction. In reply, the convener stated that experiments were being made to prevent oscillation, if at all possible. Bogie cars, he might say, were not suitable for the Glasgow quick service. Where bogie cars were used, the distances were long, and the runs not so frequent. He could not hold out any hope that bogie cars would be adopted. The report was adopted.

At a meeting of the T.C., Mr. Gibson moved that the Corporation condemn the practice whereby the tramway motormen were intimidated into paying for damages from collisions, where such damage was not the fault of the motorman. He contended that the system had been in operation for years, and that motormen had frequently complained to him of being compelled to pay for damage which had been caused to a car, and for which they were not responsible,

Mr. Hugh Alexander, in moving the previous question, said that when men entered the employment of the department they were made aware that they would be liable for damage caused through their own fault or negligence. At the same time even when a man was found to be at fault, the whole cost of repairs was not charged, and he always got the benefit of the doubt. The motion was lost by a large majority.

A remit has been made to the Tramways Committee to take into consideration the providing of workmen's weekly tickets on the same principle as that in operation by the various railway companies in Glasgow.

It has been remitted to the general manager to make a report on the different life-guards now used on the tramways.

Lord Balfour of Burleigh's decision in the arbitration proceedings between the Glasgow Corporation and the Paisley Tramway Co., in regard to the terms by which the former will have running powers over the latter system to the Cross at Paisley, has been in the hands of the town clerk for several days. Some misunderstanding has taken place as to the interpretation of one of the clauses, and the finding has, in consequence, been withheld from the public in the meantime.

Johnstone.—It is stated that Mr. Murphy will apply for an order to authorise the construction of a line from Kilbarchan to join the Johnstone line.

King's Norton and Northfield.—The U.D.C. is applying for a prov. order for electric tramways.

Llanelly.—A deputation of the U.D.C. and the Llanelly Tramways Co. met Mr. Graham Harris at the offices of the South Wales Electric Power Co. at Cardiff on November 6th, in connection with an effort that is being made to induce the company to take over the obligations entered into by another company to carry out a scheme of lighting and traction at Llanelly. The *South Wales Daily News* says that Mr. Harris informed the deputation that he was prepared to enter into an agreement with the Urban Council relative to taking over the liabilities and responsibilities of the British Insulated and Helsby Cables, Ltd., as to electric light and traction for Llanelly, but in a modified form. Further, the South Wales Power Co. propose to apply to Parliament in the ensuing session for an extension of the powers of the Carmarthenshire Power Co. to Llanelly in the event of Llanelly being willing that the Parliamentary notice should contain such a proposal. He asked that a formal assurance should be given him that the Council was prepared, subject to a suitable agreement being entered into, to approve of the extension of the powers of the Carmarthenshire Co. in the way referred to. The deputation recommended that the clerk should be authorised to write to Mr. Graham Harris intimating that the Council will offer no objection to the inclusion of Llanelly within the area of supply of the Carmarthenshire Power Co. provided a suitable arrangement be come to between the parties. The proposition was unanimously carried by the U.D.C.

London.—On Tuesday the Highways Committee reminded the L.C.C. of the agreement entered into a year ago with the North Metropolitan Tramways Co., in regard to the rent to be paid by the company for the authorised lines in St. John Street and St. John Street Road. Although to be constructed on the conduit system, the lines would be worked by horse traction until the tramways connected therewith were reconstructed for electric traction. To meet this contingency, the agreement provided that during the period that the new lines were operated by horse cars, the company should pay a rent equal to 8 per cent. per annum on the estimated cost of the lines for horse traction, with an addition for Parliamentary and other expenses; and that, when electric traction was introduced, the amount by which the actual cost of construction exceeded the total amount referred to should be taken, for the purpose of calculating the rents provided for in the company's lease, as the cost of reconstruction of the new tramways for electric traction. As the company was willing, the Committee proposed to enter into a similar arrangement in relation to the projected conduit tramways in Rosebery Avenue. The cost of these lines for horse traction was estimated at £10,945, and at £26,000 for electric traction, exclusive of cables, &c.

The Board of Trade has confirmed the order authorising the construction of the London United Tramways (1901) Ltd.'s extensions between Hounslow and Cranford and between Heston, Hounslow, Handsworth, Twickenham, and Sunbury Cross.

Metropolitan Railway.—It is stated that the directors of the Metropolitan Railway Co. have, since Thursday last week, been carrying out a series of trials of new electric trains on the Neasden section of the line.

Mexico.—According to the *Elektrotechnischer*, the Mexican Railway Co. intend introducing electric traction on the line, which, at present, serves the district of Mexico at Vera-Cruz, and which will have a development of 420 km. The railway anticipates, by reason of the high price of coal in Mexico, an annual economy of $500,000.

Paisley.—Colonel von Donop, on behalf of the B. of T., made the official inspection on the Renfrew and Abbotsinch sections of the Paisley and District Electric Tramways last week. The inspection completes the system of electric tramways inaugurated on November 2nd last year by Mr. W. M. Murphy. The system connects Johnstone and Renfrew with Paisley, and from the Paisley Cross there are branches extending southwards to Charleston and Potterhill, and northwards to Abbotsinch on the McHinnan Road. It was originally intended to extend the tramways to Meikleriggs and St. James's Park, but these have been postponed meantime. Colonel von Donop gave a general approval of the work. At a luncheon which followed the inspection, Mr. Brindle, the manager of the tramways, said that since the cars had started over a million passengers had been carried, and £1,900 had been paid to the Paisley Corporation for current.

Southport.—Arrangements have been made with the Westinghouse Co. for equipping the Pier tramroad electrically, and the work is to be commenced forthwith.

Southport and the Overhead Railway.—The operations for "joining up" the Liverpool Overhead Railway with the recently electrified Lancashire and Yorkshire Railway at Seaforth is rapidly nearing completion. The new line forming the junction will extend about half a mile, and passengers will be able to take a ticket from any station on the Overhead Railway to any particular station on the Lancashire and Yorkshire system. Many difficulties have beset the contractors, but they have all been surmounted, and it is expected that in February next the line will be opened. The third rail will be in a similar position to that of the Lancashire and Yorkshire Railway. This has been found necessary to facilitate the working of the two lines. The Lancashire and Yorkshire are making certain alterations in rolling stock, &c., so that trains can, without difficulty, be worked through on to the Overhead Railway.

South Shields.—At the last meeting of the R.D.C., the old question of a tramway from South Shields to Sunderland was raised, and, after discussion, a committee was appointed to consider the desirability of powers being obtained for constructing a line from the terminus of the Sunderland Corporation tramways to that of the proposed lines of the new South Shields borough trams. As will be remembered, an attempt had already been made to get powers for the construction of such a line, but the proposal was not sanctioned.

Swedish Railways.—The *Elektrotechnische Zeitschrift* reports that the Swedish Government single-phase alternating current railway trials are to commence next spring. The power station, which is being constructed near Tomteboda, will contain two De Laval steam turbines, with generators coupled directly and giving single-phase alternating current at 15—20 periods, as well as transformers for pressures of 3,000 : 20,000 volts. Two electric locomotives are to be employed, one made by the Westinghouse Co. and the other by Messrs. Siemens-Schuckert. The Allgemeine Elektricitäts Ges., of Berlin, will supply a train composed of four carriages. Two of the vehicles will have two Winter-Eichberg motors each for current at 25 periods and 6,000 volts. These carriages, lighted and heated electrically, will be provided with continuous vacuum brakes.

Wednesbury.—The announcement was made last week that the difficulties which have resulted in so much inconvenience to the travelling public, and have caused a complete stoppage of the service between Wednesbury and Darlaston for some months past, are in a fair way to being satisfactorily settled. A scheme for the complete electrification of the whole system is to be undertaken immediately, the directors of the tramway company having sanctioned this step. As soon as the contracts can be issued, and the arrangements made, the work will be put in hand.

Worcester.—A year's extension of time, in which to complete the electric tramways in the city, has been applied for by the tramway company.

TELEGRAPH AND TELEPHONE NOTES.

The Marconi System in the East.—It is reported from Amsterdam that the Marconi Wireless Telegraph Co. has for some time past had a footing in Holland, inasmuch as the *Handelsblad* has its reports forwarded daily from London by wireless telegraphy. The State monopoly of telegraphy, however, prevents any other supply of telegrams in Holland, but it seems as if the proposed establishment of a system of wireless telegraphy in the Dutch Indies is not to be carried out for and worked by the Government itself. General van Heuts, the new Governor-General of the Dutch Indies, recently made an inspection of the Marconi station at Amsterdam before his departure to the East. Negotiations then took place with the Colonial Minister, and the draft of an agreement was prepared, which would give the Marconi Co. a monopoly for the Indies. It is not yet known whether the agreement has been signed, as the last information to hand was to the effect that negotiations were still proceeding between the Minister for the Colonies and the company.

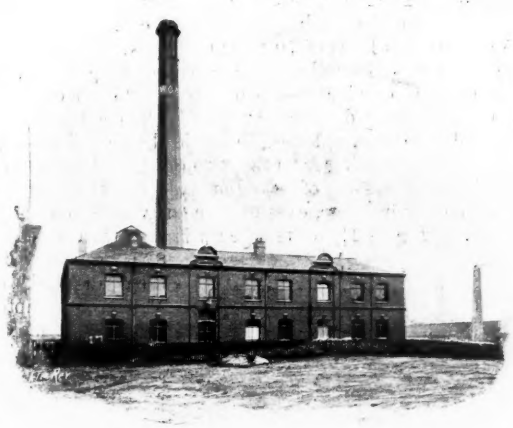
Swansea Telephones.—A local paper says that the legal agents of the Corporation have served a writ upon the National Telephone Co. in order to enforce the rights of the former to demand intercommunication between the subscribers of the rival systems in the town.

Telephone Wires.—The N.T. Co. wanted to place six wires over the river at Wallingford because the expense of laying a cable under the river would be prohibitive, having regard to the rates charged to subscribers; but the Thames Conservancy Board would not give its consent to the overhead wires.

(*Continued on page* 832.)

THE RADCLIFFE U.D.C. ELECTRICITY WORKS.

The electrical undertaking of the Urban District Council of Radcliffe dates from the year 1895, when the Council decided to provide a lighting and tramway system for the



Radcliffe Electricity Works.

district, which has a population of about 25,000. A loan of £21,500 was granted for the work, and in 1902 specifications were prepared for the various sections of the scheme by Messrs. Lacey, Sillar & Leigh, the consulting engineers. The whole of the work has been successfully carried out under the supervision of the consulting engineers, and the Council's electrical engineer, Mr. Henry.

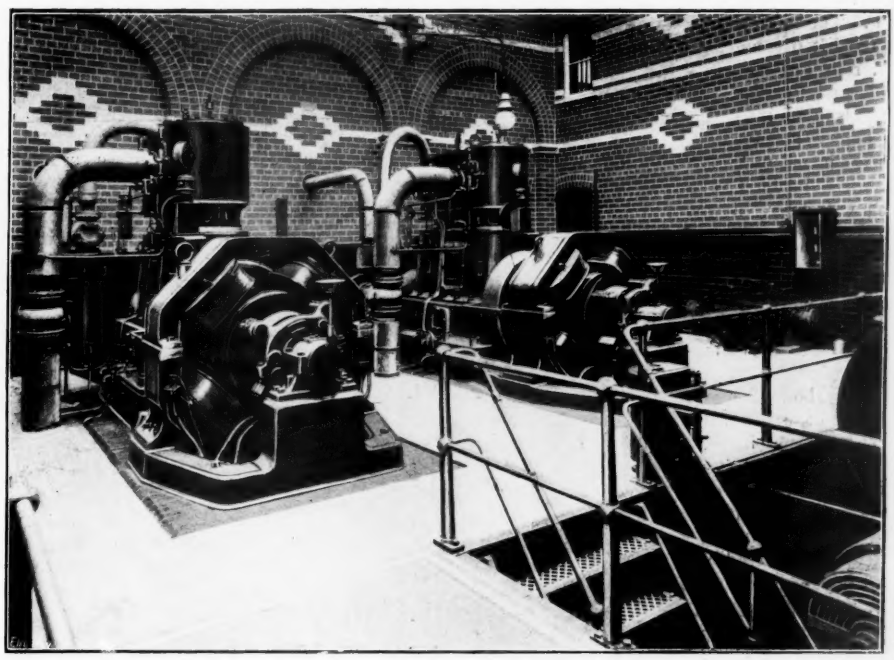
Some 7 miles of tramway track have been constructed by the Council, which has also installed a traction switchboard at the station, and laid the necessary feeder cables, &c. The Bury Corporation will, however, work the routes, in connection with which it has provided the overhead equipment and rolling stock. The construction of the permanent way and overhead equipment is at present in progress, and it is expected that the complete system of tramways will be in operation shortly.

The generating station is conveniently situated in Lomax Street on the banks of the River Irwell, from which the water for condensing purposes is obtained. The plans of the buildings were prepared by Mr. Rothwell, the Council's surveyor, and Messrs. Sandyford & Thornley were the contractors for the work.

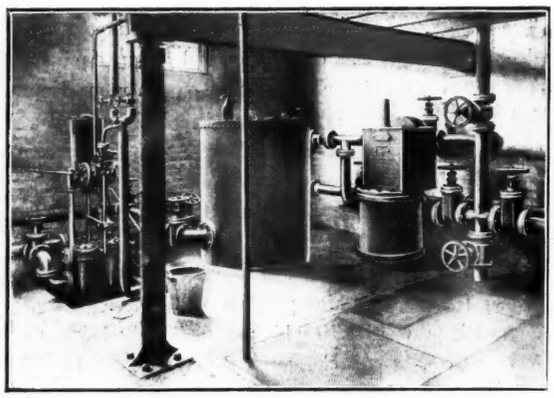
The buildings comprise boiler and engine houses, accumulator room, test room, offices, &c., and adequate provision has been made for extensions. The engine room is provided with a basement, in which are installed the condenser pump, a motor-generator and balancer, and the necessary pipes and cables.

In the boiler house are installed two Lancashire boilers, supplied by Messrs. Edward Heaton & Sons. Each boiler is 30 ft. long and 7 ft. 6 in. in diameter, with a grate area of 36 sq. ft., and a working pressure of 160 lbs. per square inch, and is provided with "high steam" and "low water" safety valves, two check feed valves, and other fittings of usual type. The above firm also supplied two superheaters of McPhail & Simpson type, which are erected at the back end of the boilers in the path of the boiler flues. Each superheater is fitted with a 2-in. bye-pass pipe and valve, also with a safety valve, thermometer pockets, &c. An economiser of the Green type is fixed in the main flue, and consists of 192 tubes, each $4\frac{9}{16}$ in. diameter, and 9 ft. long, divided into two sections in rows of eight tubes wide, and the scrapers for this are driven by a 2-H.P. Lundell motor. The boiler house, economiser, arrangement of steam piping, &c., are clearly shown in the figure on p. 828.

In the pump room are situated two boiler feed pumps, supplied by Messrs. Mather & Platt. One of them is an electrically-driven pump, and the other a steam-driven pump; either is capable of delivering 1,800 gallons of water per hour against a steam pressure of 160 lbs. per sq. in. The electrical pump is of the three-throw variable-stroke type, with a speed of 180 r.p.m., and is driven through single reduction gear from a shunt-wound motor. The steam pump is of the "Weir" simple direct-acting vertical type. The feed pumps draw from a hot-well in the pump room, or alternatively from the town supply or river, and deliver through a Kennedy meter and Rankine feed-water filter, either through the economiser or direct to the boilers.



Interior of Engine Room, with Browett, Lindley-Mather & Platt Generating Sets.



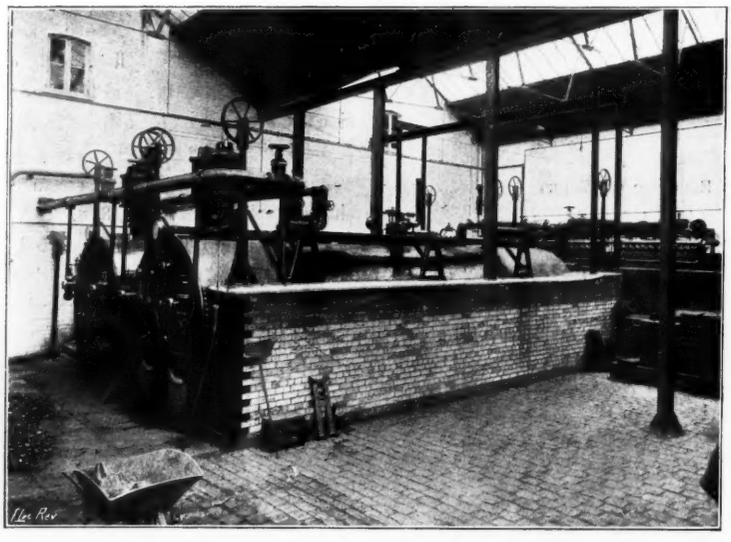
View of Pump Room, Radcliffe.

The condensing plant is situated in the engine room basement, and was also supplied by Messrs. Mather and Platt, Ltd.; it is of jet type, with three-throw pumps electrically driven. The jet nozzles are of renewable type, and the condenser is of sufficient size to deal with 15,000 lbs. of steam per hour, and to give a vacuum of 26 in. with cooling water at a temperature of 65° F. The cooling water is lifted some 15 ft. from the River Irwell, and the discharge is taken into the hot well previously mentioned, the latter being provided with an overflow into the river. The air pump is of the three-throw Edwards type, driven through single reduction gear by a Mather & Platt motor.

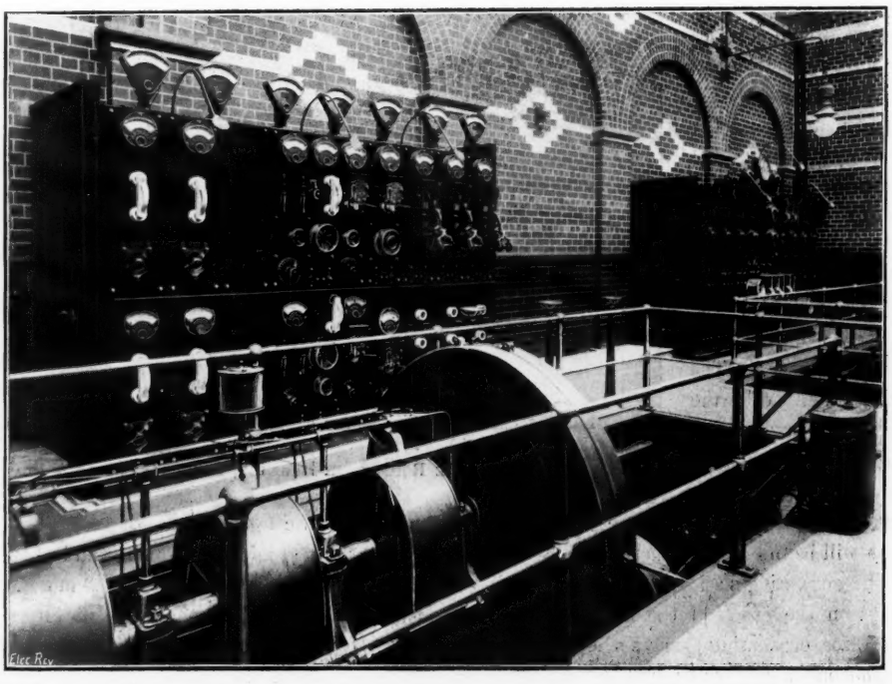
Each boiler and engine unit is coupled direct by steam piping, and an interconnecting main is provided for inter-working when desired. The superheaters can be readily lifted out for examination, and short steam pipe lengths are provided for replacing them in the steam main. The main steam pipes are of lap-welded steel, and the exhaust pipes of cast-iron; in connection with the latter, an alternative atmospheric exhaust is provided for working non-condensing. The various steam, exhaust, feed, and water-pipe accessories were supplied by Messrs. John Wolstenholme & Son. Hopkinson valves are used on the steam pipes.

The generating plant consists of two 120-KW. steam dynamos supplied by Messrs. Mather & Platt, with engines by Messrs. Browett, Lindley & Co. The engines are of the two-crank enclosed vertical compound type, rated at 200 I.H.P. on normal loads with a speed of 500 r.p.m., and a steam pressure of 140 lbs. per sq. in. Each dynamo has a capacity of 120 KW., the output when working as a shunt machine being 250 amperes at 480 volts. When running as a compound machine, each dynamo has a constant pressure of 550 volts, with loads of 70 to 220 amperes. The outputs of the steam sets given above are when working normally, but each set is capable of an overload of 25 per cent. for short periods. The dynamos are four-pole machines with bar-wound armatures, and are each provided with a throw-over switch for changing over from shunt to compound working.

A balancer consisting of two four-pole machines coupled together on one bedplate, each machine having an output of 50 amps. at 220 to 240 volts when running at a speed of 800 r.p.m., has been supplied by Messrs. Crompton and Co. A motor-generator set has also been supplied by the same firm; it consists of two 16-KW. dynamos and one motor, all mounted on one bedplate. This set may be used for supplying energy for the lighting supply, or for battery charging, being driven off the traction bus-bars. It is also available for energy supply to the car-sheds at 550 volts—the dynamos acting as motors driven



Interior of Boiler House, Showing Economiser &c., Radcliffe.



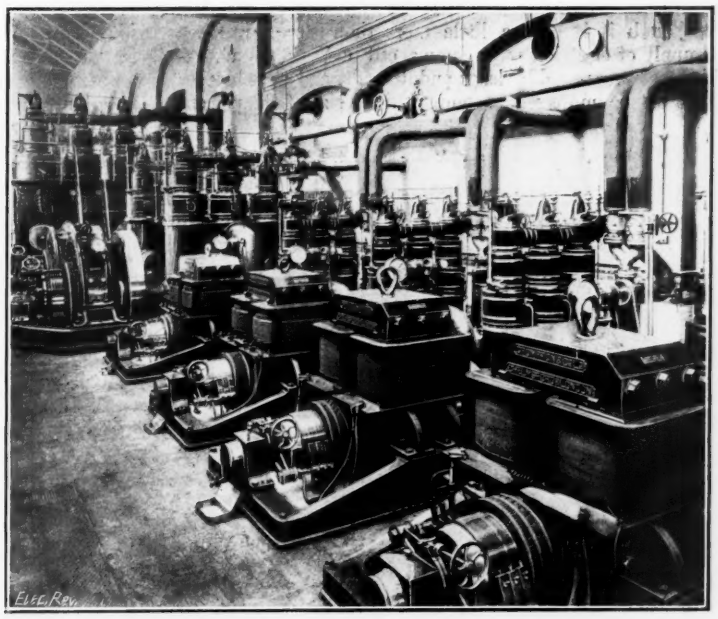
View of Lighting and Traction Switchboards, Condensing Plant &c., Radcliffe.

from the lighting bus-bars, and the motor acting as the dynamo.

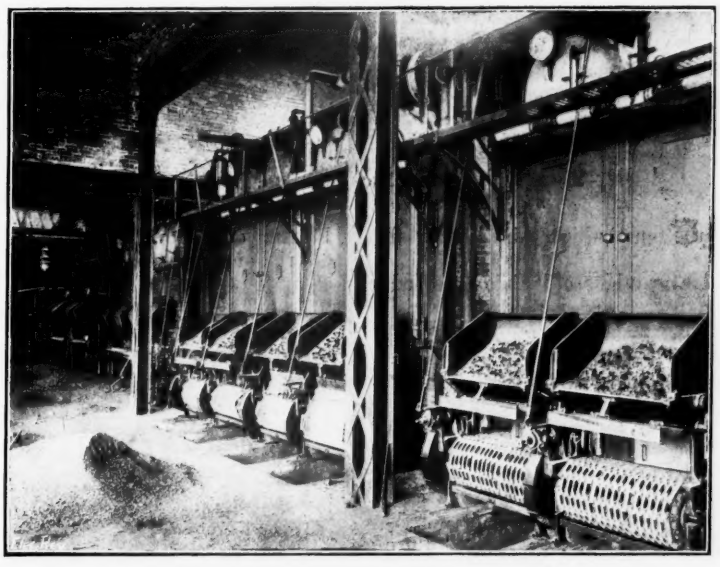
The lighting and traction switchboards were supplied by Messrs. Statter & Co., and consist of enamelled slate panels provided with measuring instruments of Crompton type. The lighting board comprises three dynamo, two balancer (one spare), a motor-generator and battery panel, and two feeder panels. The panels are divided into positive and negative, upper and lower halves respectively, with circuit-breakers of Messrs. Statter's make. The traction board comprises three dynamo and one motor-generator panels, a Board of Trade and three feeder panels, &c.—the circuit-breakers in this case being of B.T.H. make.

The battery was supplied by the British Accumulator Co., and consists of two sets of 123 cells and 6 spare cells, making in all 252. The cells are of glass, and have Planté positive and pasted negative plates. The battery is capable of giving a discharge of 40 amperes over a period of 10 hours and 180 amperes for a period of 1 hour. A ten-ton hand-worked travelling crane, supplied by Messrs. J. Spencer and Co., spans the engine room.

The station wiring for lighting and power, was carried out by Messrs. D. Firth and Sons, two auxiliary switchboards being fixed in the engine room, one for the control of the lighting and one for the control of the motors. The station is lighted by eight arc and 90 incandescent lamps arranged on a two-wire system, which can be fed from either side of the three-wire supply; the wiring throughout is in screwed iron conduit.



York Electricity Works: General View of Generating Plant.

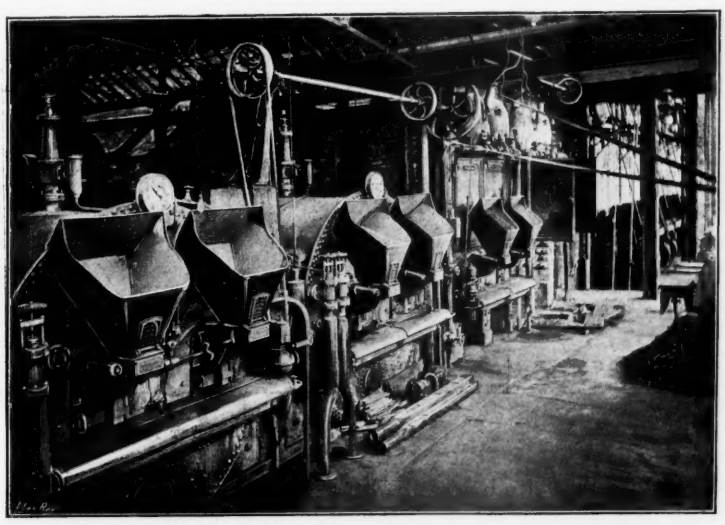


Babcock & Wilcox Boilers and Chain-grate Stokers, at York.

The lighting and traction cables, pilots, conduits, &c., were supplied and laid by Messrs. The Callender Cable and Construction Co. They are three-core, paper-insulated, lead-sheathed; the two main feeders are of ·2—·1—·2 sq. in. cross-section, drawn into stoneware conduits, and terminate in two feeder pillars, from which ·06—·03—·06 sq. in. distributor cables of similar type, but laid solid in Howard troughing, radiate.

The feeder cables and pilots for the tramways are in all cases single-core lead-covered paper-insulated cables drawn into stoneware conduits.

The supply of electricity for lighting and power purposes was commenced about the end of August, and the works were formally opened on October 5th.



York: Lancashire and B. & W. Boilers, with Bennis Stokers.

YORK CORPORATION ELECTRICITY WORKS.

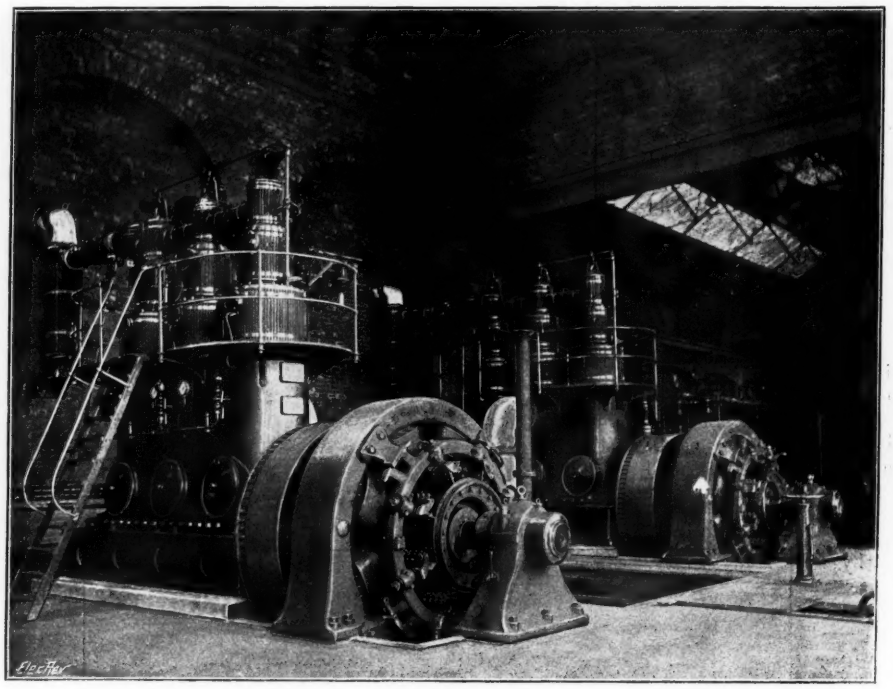
Visitors to the ancient City of York are generally absorbed with the desire to see the works and ruins of bygone days, and many antiquarians would grow indignant were it suggested that by many citizens the possession of a modern electric lighting station was more highly prized than that of the relics of ancient times.

Although it is only a little more than four years since the supply of electricity was commenced in York, the undertaking has progressed by leaps and bounds, and the observer cannot but be impressed on comparing the size of the present station with that of the one which existed when the scheme was inaugurated.

The undertaking, like many others of its kind, has had a great deal of opposition to face, and it speaks well for the officials that, by unwavering zeal and enterprise, they have been the means of making the venture so very successful.

On April 1st, 1900, the station, designed by Prof. Kennedy, was formally opened, being then capable of supplying 6,500 8-c.p. lamps. Briefly, the plant in the engine room comprised two 75-kw. and two 25-kw. Crompton-Willans steam dynamos, two boosters driven by a 460-volt motor for charging the batteries, a switchboard of five panels of enamelled slate by Messrs. Crompton & Co., Ltd., Chelmsford, and an eight-ton travelling crane by Messrs. Carrick and Ritchie, having a span of 31 ft. Adjoining the engine room was a 250-ampere-hour battery supplied by Messrs. The Tudor Accumulator Co.

In the boiler house the plant consisted of two Lancashire boilers 28 ft. long × 8 ft. diameter, working at a pressure of 125 lbs. per sq. in., by Messrs. R. Taylor & Sons, of Marsden; one economiser of 192 tubes erected by the well-known makers, Messrs. Edward Green & Sons, Wakefield, and two electrical feed pumps of the three-throw plunger type built by Messrs. Wagner & Co., Walton-on-the-Naze.

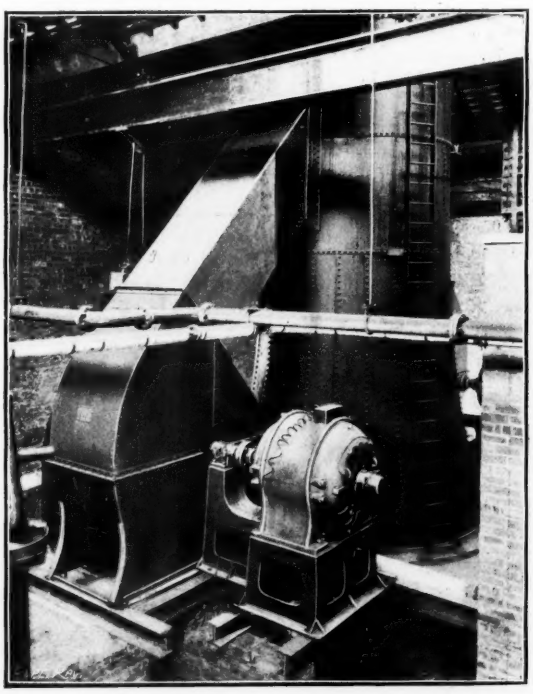


York: New Willans-Dick, Kerr Generating Sets.

York Electricity Works.

Further details of the plant will be found in the illustrated description which was published in the Electrical Review of April 13th, 1900.

Before this plant had been running for many weeks, it became evident that, to meet the great demand which was being made for current, extensions would have to be carried out, and the Council, on the recommendation of Mr. Midgley, city electrical engineer, obtained powers to borrow £40,000 for this purpose.



Davidson Induced-Draught Plant.

Two Babcock & Wilcox water-tube boilers, fitted with Bennis mechanical stokers, were added in the boiler house, and two Crompton-Willans 220-KW. sets were installed in the engine room. About the commencement of the year 1902 it was found necessary to remove the two small 24-KW. sets in order that the available space could be utilised for installing two 75-KW. Crompton-Willans sets.

It was also resolved about this date to considerably enlarge the battery, and to this end another story was added to the original battery room, whereby the Corporation was enabled to put down a new battery of 1,000 ampere-hours capacity. This battery was supplied by Messrs. The Tudor Accumulator Co. in exchange for the existing one; and the additional expenditure incurred amounted to £2,500.

A sum of £8,500 was also spent on extending the mains, as, in many parts of the city, the original cables were considerably overloaded.

Further extensions were afterwards made in the station, two Weir steam pumps of the vertical double-acting type being installed, as well as a large booster for charging the battery, which was erected by Messrs. The Lahmeyer Electrical Co., who also supplied a balancer capable of dealing with an out-of-balance load of 200 amperes.

The capacity of the station at this time was 1,200 H.P., but, owing to the phenomenally growing demand for energy, the plant in the station during the winter of 1902 was very severely taxed; in fact, all the available plant in the works was required, and had any of the machines broken down, the result would have been disastrous.

It was plain to be seen that this state of affairs could not continue, so in the commencement of the following year the Council decided to carry out extensions on a very large scale, and on the advice of the city electrical engineer, an application was made for a further loan of £50,000.

The scheme decided on necessitated the pulling down of the offices, stores, &c., and on account of the land on which the new building was to be erected being of a very treacherous nature, 20-ft. piles had to be used in order to secure a foundation.

The new station, in the building of which Castleford bricks have been used, was designed by Mr. C. A. Midgley, the city electrical engineer; the city surveyor (Mr. A. Creer) was responsible for the architectural details. The engine room is 122 ft. long × 47 ft. wide, with a height of 36 ft. to the eaves, and along the side fronting the street are seven windows, 18 ft. × 10 ft., which provide for the efficient lighting of the room. At the western end of the engine room a switchboard gallery has been erected 13 ft. above the floor level, which commands an uninterrupted view of the whole of the old and new engine rooms.

The committee room, offices, stores, testing rooms, lavatories, &c., adjoin the engine room, while beyond these rooms is a large yard used for storing cable, &c.

The plant which has been erected in the new engine room consists of two Willans & Robinson high speed engines of the vertical compound type, capable of developing 850 H.P. when running on full load with 120 lbs. steam pressure at the stop valve, and they are each coupled direct to a 520-KW. dynamo of the continuous-current shunt-wound type, with drum armature, manufactured by the English Electric Manufacturing Co., Preston. These dynamos have been so arranged as to be suitable for traction work, and the series winding which has been provided is proportioned to raise the voltage of the machines from 500 volts at no-load, to 550 volts on full-load, without adjustment of the shunt regulating resistance or alteration of the governors of the engines.

At present the two new sets are each provided with a switchboard panel fixed temporarily between the old and new engine rooms, as, when the new board now in hand is completed, the original board in the old engine room will be disposed of, and the whole of the switchgear in the station will be worked from the new board, which will be 32 ft. long.

An electrically-driven surface condenser has been supplied by Messrs. Allen & Sons, Bedford, and is capable of dealing with 30,000 lbs. of exhaust steam per hour, with a guaranteed vacuum of 26 in. on all loads. The air pump in connection with the condenser is of the Edwards well-known type.

The crane, which has been manufactured by Messrs. Higginbottom & Mannock, of Manchester, is of 47 ft. span, capable of lifting and traversing a load of 20 tons, and has been so designed, that when the carriage is in the centre of the crane and carrying full-load, the deflection does not exceed $\frac{3}{16}$ in. All motions of lifting and travelling are worked from the platform, which stretches across the whole length of the crane. On the stone blocks on which the rails for the crane are fixed, polished steel handrails have been fitted, and a gallery made which runs the full length of the engine room, and is reached by means of an iron ladder at one end of the room.

In the boiler house, which has been built at the northern side of the engine room, three Babcock & Wilcox water-tube boilers of 1,000 H.P. each have been erected. These boilers are fitted with chain-grate stokers, and are each capable of evaporating 14,000 lbs. of water per hour when working at 130 lbs. per sq. in., with the feed water at a temperature of 60° F. Superheaters have also been supplied, which allow of 80° to 100° F. being added to the temperature of the steam at the engine stop valve.

The valves used in connection with these boilers were made by Messrs. J. Hopkinson, Huddersfield, and are easily accessible by means of platforms and ladders fixed at the back and front of the boilers.

The water supply to the boilers is effected by means of two Weir steam pumps which are erected in the pump room, dividing the boiler plant into two banks of four each. These pumps are of the vertical double-acting type, and they are each capable of lifting and delivering to the boilers 2,500 gallons of water per hour, against 130 lbs. steam pressure.

The storage tank, which has been fixed above the pump room, is constructed to hold 75 tons of water, and is 18 ft. × 18 ft. × 5 ft. deep; thickness of plates, $\frac{5}{8}$ in.

The new steel chimney, which is the first of its kind to be erected in York, was supplied by Messrs. Head, Wrightson and Co., Thornaby-on-Tees, and is 116 ft. high, 7 ft. in diameter at the top, and 13 ft. diameter at the base. The top section of plates are $\frac{1}{4}$ in. thick, the middle section $\frac{5}{16}$ in., and the last 40 ft. of plates are $\frac{3}{8}$ in. thick. A fire-brick lining has been built to within 50 ft. of the top, and on the outside of the chimney a wrought-iron ladder has been provided for obtaining access to the top.

The induced draught installation in connection with this chimney has been carried out by Messrs. Davidson & Co., of Belfast, and comprises two 50-in. Sirocco centrifugal cased fans with single inlet, semi-overcast type, with full housing, each direct-coupled to a 40-H.P. semi-enclosed motor, shunt-wound for 460 volts, with a speed of 500 r.p.m., manufactured by Messrs. Dick, Kerr & Co. These motors are fitted with starting switches and field regulating resistances, capable of varying the speed from 500 to 600 r.p.m.

A new economiser of 480 tubes, arranged in four groups of 120 tubes each, has been arranged by Messrs. E. Green and Sons, of Wakefield. The scrapers are driven by a 4-H.P. motor running at 550 r.p.m.

The supply of coal for the station will be hauled up a line now under construction from the North-Eastern Railway Co.'s siding in the Corporation depôt, by three electric capstans, each driven by a 40-H.P. motor wound for a pressure of from 460 to 500 volts, and capable of drawing a load of 68 tons up an incline of 150 ft., with a gradient of 1 in 16, at the rate of 100 ft. per minute.

The coal-handling plant, which is being erected by Messrs. Gibbons Bros., Ltd., of Dudley, is not yet in working order. The plant is to be worked by two motors, one fixed at the elevator head, and one at the end of the conveyor opposite to the elevator, and the storage bunker in connection with this plant will be 123 ft. long × 17 ft. wide × 12 ft. deep.

From the foregoing particulars it will be seen that the authorities in York have in their possession a well equipped station that should in the near future prove to be a valuable asset to the city, and as the popularity of the undertaking is still in the ascendant, it is confidently anticipated that the number of units generated during the year ending March 31st, 1905, will amount to considerably over 1,000,000.

The specially low charge made for energy for motive power purposes has been the means of inducing many users of power to go in for electric driving, and Mr. Midgley, who has held the office of city electrical engineer since July,

1899, has great hopes that his efforts to increase the day-load, which now stands at about 600 H.P., will ere long be rewarded.

In conclusion, it may be added that a renewed agitation has commenced with regard to the electrification and extension of the present tramway undertaking, which is owned by a private company, and it is to be hoped that before very long, an up-to-date electric tramway system will be added to the city's possessions.

TELEGRAPH AND TELEPHONE NOTES.

(*Continued from page* 826.)

Australian Telephones.—A Sydney paper quotes a dispatch from Melbourne, as follows:—"Mr. J. Hesketh, the Commonwealth electrical expert, who is investigating the latest improvements in telephones and telegraphy in the United States, informed the Postmaster-General in a letter by last mail from Chicago that he expected to get to New York by the end of September, and to leave for England by the middle of November. Tenders were recently called for a telephone switchboard for the Hobart exchange, and the apparatus was expected to cost some thousands of pounds. Mr. Hesketh, in his letter, strongly urges that the acceptance of tenders should be deferred, as from what he had seen of automatic and other modern switchboards he is satisfied that in comparatively few years the Hobart system would be out of date. The Postmaster-General has accordingly postponed the date for acceptance of the tenders. Some time ago it was proposed to install a new switchboard in the Melbourne exchange and in other places. This project was shelved pending a thorough investigation of the methods adopted in other parts of the world. From reports received from Mr. Hesketh, it is expected that the improvements he will be able to recommend will amply compensate for the loss of time in modernising the systems."

Buenos Ayres Telegraphs.—The Administration of Posts and Telegraphs of Buenos Ayres, Argentine Republic, announces in a letter to the Bureau at Berne that, in accordance with the arrangement concluded between it and the Chilian Administration, the lines of the two countries have been joined at Uspallata, in the province of Mendoza, where a new telegraph station has been opened to the public.

The Proposed Iceland Cable.—The negotiations in regard to the proposed cable to Iceland have been brought to a close. The work will be carried out by the Great Northern Telegraph Co., of Copenhagen, the cost being estimated at 2,000,000 kronen. The company, which will receive a Government subsidy of 89,000 kronen per annum for a period of 20 years from the opening of the line, intends to expend a further sum of 300,000 kronen for the establishment of a landline from Reykiavik to the east coast of Iceland, where the cable from the Faroe Islands will end. The new connection will be from the Shetland Islands, which are in telegraphic communication with Scotland, to the Faroe Islands and thence to Iceland, and it is expected that the cable will be ready for traffic in 1906. It is intended to erect a cable station at Thorshavn in the Faroe Islands, and the line will end at Lerwick, in the Shetland Islands.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Antigua-St. Kitts	Nov. 11, 1904	Nov. 13
Trinidad-Demerara (No. 1)	Aug. 26, 1901	..
Trinidad-Demerara (No. 2)	Oct. 10, 1904	..
Dominica-Martinique	May 7, 1902	..
St. Lucia-Martinique	May 7, 1902	..
Cayenne-Pinheiro	Aug. 13, 1902	..
Reissa-Issa (Yemen)-Camaran	Oct. 22, 1902	..
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	..
Closed { Port Arthur-Chefu	Mar. 9, 1904	..
Paramaribo-Cayenne	July 18, 1904	..
Swakopmund-Mossamedes (under repair)	Oct. 10, 1904	..
Bolama-Bissao	Oct. 13, 1904	Nov. 15
Nassau-Jupiter Inlet	Oct. 20, 1904	..
Rhodes-Sitia	Nov. 1, 1904	..
Salonica-Lemnos	Nov. 6, 1904	Nov. 13
Mozambique-Majunga	Nov. 15, 1904	..
Tarifa-Tangier	Jan. 18, 1904	..
Santa Cruz de Teneriffe-Tejita	Nov. 11, 1904	..
Marseilles-Barcelona	Nov. 11, 1904	..
Sitka-Valdez	Nov. 11, 1904	..
Landlines.		
Cartagena-Baranquilla	Dec. 8, 1900	..
Puerto-Barrios	July 28, 1902	..
Caimanera-Santiago	June 15, 1904	..
via Bhamo beyond Tingyuch	Oct. 15, 1904	..
Kertch-Soutehoum	Sept. 27, 1904	..
Saigong-Bangkok	Nov. 10, 1904	Nov. 11
Saigong-Bangkok	Nov. 15, 1904	..
via Fao route	Nov. 9, 1904	Nov. 10
Moulmein-Bangkok	Nov. 11, 1904	Nov. 13
Rome-Constantinople	Nov. 15, 1904	..

Owing to last week's storms, the cables from England to France were interrupted, and the morning newspapers were able to publish only a portion of their usual telegrams from the Continent.

A Reuter's dispatch to the *Standard* on November 14th states that a severe storm of wind, rain and snow, has thrown down the wires throughout the Eastern States, interrupting communication with the South and West of the U.S.A. Many points are completely isolated, both as regards telegraph and telephone communication, and other sections can only be reached by the most circuitous routes. The wind was blowing at the rate of 48 miles an hour.

The Telegraph Cable Export Trade.—No improvement is noticeable in the export trade of this country in telegraph cables and apparatus connected therewith, the returns for October last showing a total of only £69,186, bringing up the total for the first 10 months of the year to £696,708, as compared with £1,619,628 in the corresponding period of last year, and £2,658,414 in the 10 months ending with October, 1902.

West African Telegraphs.—The Bureau International des Administrations Télégraphiques notifies that the construction of the telegraph line on the Ivory coast, West Africa, to Baoulé, has been completed as far as Toumodi, and a telegraph office will be opened there; one has already been opened at Rodiocoli. New offices have also been opened to the public at Balombo, Quimbale and Bailundo, in Benguela, in the province of Angola.

Wireless Telegraphy.—It is announced that the Government of Cuba has granted a concession to the Berlin Wireless Telegraph Co. for the establishment of two stations on the Telefunken system. One is to be erected at Havana and the other on the Island of Pinas. The Cuban Government desires to make experiments with these stations in order to decide whether wireless telegraphy should be introduced as a means of communication in that country.

It is reported that the Canadian authorities are much interested in the attitude of the Imperial Government towards the national control of wireless telegraphy. It has been agreed that if Great Britain assumes the lead in this matter and takes over the direction of the stations in the British Isles, Canada will do the same in the Dominion.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—December 28th. A notice appears in the *Board of Trade Journal* to the effect that tenders will be received at the office of the Deputy Postmaster-General, Perth, W. Australia, for the supply of the undermentioned telephone material, for use in that State:—19½ miles 26-pair lead-covered cable, dry-core, to standard specification No. 7; 5,000 paper sleeves, 3 in. long by $\frac{3}{16}$ in. diameter; 350 yds. paper strips, 2 in. wide. General conditions, special conditions, specifications, schedule of items and tender forms may be obtained at the General Post Offices at Perth, Adelaide, Melbourne, Sydney, Brisbane and Hobart.

Belfast.—November 18th. Permanent way, overhead electrical equipment, feeders, telephone and other wires, conduits, steam dynamos, switchboard, three-phase plant, condensing plant, boilers, coal conveying plant, piping, pumps, tramcars, &c., for the Corporation. See "Official Notices" November 4th.

Bolton.—November 30th. The Electricity Committee has a vertical engine and two alternators for sale. See "Official Notices" November 11th.

Bromsgrove.—Engines, dynamos, booster, steam services, storage battery, switchboard, ring main, feeders, wiring lamps, &c., for the new lunatic asylum. See "Official Notices" to-day.

Caledonian Railway.—November 21st. Tenders are invited for a year's stores, including telegraph and telephone appliances, electric lighting material and fittings, &c. Specifications, &c., from Mr. J. Lorimer, Stores Superintendent, Caledonian Railway, Charles Street, St. Rollox, Glasgow.

Deptford.—November 22nd. Pipework for the Town Hall electric lighting installation. See "Official Notices" November 11th.

Dublin.—December 5th. The D.U.T. Co. wants tenders for a year's stores. See "Official Notices" to-day.

France.—December 1st. The Municipal Authorities of Paris are inviting tenders for the supply and erection of a 60-H.P. steam engine and 40-KW. continuous-current dynamo in the Municipal School of Physics and Industrial Chemistry for lighting and power purposes. Particulars may be obtained from, and tenders are to be sent to, l'Hotel de Ville, Paris.

Glasgow.—The Tramways Committee will advertise for the equipments for the new cars authorised to be constructed.

Holland.—November 25th. Tenders are being invited by the Hague Tramways Co. for the supply of 25 electric motor tramcars. Tenders are to be sent to the Haagsche Tramweg Maatschappij, The Hague, whence particulars can be obtained for one florin.

Johannesburg.—December 27th. Transformer pillars and switchgear; also two 35-ton electric overhead travelling cranes, for the Municipal Council's electrical undertaking. See two "Official Notices" October 28th.

Leith.—November 26th. 30 electric double-deck cars; seven ditto with top covers, sprinkler car, &c., for the Corporation; also tram rails, fish-plates, fish-bolts and tie-bars. See two "Official Notices" this week.

Llandilo.—December 6th. Testing and calibrating the electricity meters installed in the town (70) for the U.D.C.

Manchester.—November 22nd. Three electric travelling cranes for the Tramways Committee. See "Official Notices" November 11th.

Newport (Mon.).—November 21st. Machine tools for the Electricity Department. See "Official Notices" November 11th.

Perth.—The T.C. on Monday resolved to invite offers for the erection of the additional plant which would be required in view of the electrification of the tramways, and to apply to the Secretary of State for Scotland for authority to borrow £6,000 to meet the cost.

Oldham.—November 25th. Two negative return feeder boosters with switchgear and boards, for the tramway system. See "Official Notices" November 11th.

Roumania.—January 28th, 1905. Tenders are being invited by the municipal authorities of Guirgin for the concession for the electric lighting of the town.

Salford.—December 3rd. One feeder booster. See "Official Notices" to-day.

Shanghai.—March 31st, 1905. Construction and working of 24 miles of electric tramways on the trolley system, double or single. See "Official Notices" October 14th.

Swansea.—December 1st. Motors and starting switches—12 months' supply. See "Official Notices" to-day.

Whitby.—November 21st. 200-KW. direct-current dynamo and high speed engine, also one water-tube boiler with chain grate stoker, for the U.D.C. See "Official Notices" October 21st.

CLOSED.

Bermondsey.—The B.C. has accepted the tender of Messrs. Wm. Dowell & Co. for 1,200 tons of small coal (Watson's washed nuts, specially prepared for chain grate stokers) at 13s. 6d. per ton, and the tender of Messrs. Cockerell & Co. for 1,000 tons of Welsh coal (Bwllfa) at £1 1s. per ton.

Devonport.—The Admiralty has accepted the tender of Mr. James Crockerell, of Portsmouth, for the erection of a generating station and chimney stack at the Devonport Naval Electricity Works.

G.W. Ry.—The Howard Conduit Co., Ltd., of Trafford Park, have received the order, through Messrs. Siemens Bros., for the troughing required in connection with Messrs. Kennedy and Jenkin's specification for the Great Western Railway electrification.

Hammersmith.—The B.C. placed the following orders on Wednesday:—With Messrs. Richardsons, Westgarth & Co. for a third service condenser, at £1,600; with the Thermal Storage Co., Ltd., for thermal storage plant (four vessels), at £2,616; with Messrs. Robey & Co. for feed water heater, at £430.

Limerick.—The E.L. Committee on 3rd inst. decided to accept the tender of Messrs. Wm. Coates & Son, Ltd., of Dublin, at £328, for the supply and erection of an electrically-driven pump, with the necessary piping, cabling, &c. The pump is for the purpose of supplying a reserve of cooling water for the power house.

Plymouth.—The War Office has placed a contract for the supply of 67 of the Hart standard lighting type cells (having a capacity of 600 ampere-hours) required at Plymouth, with the Hart Accumulator Co., Ltd.

Woolwich.—The B.C. has given a contract to Messrs. Kelvin & James White (£374) for instruments, &c., for the new Plumstead switchboard, to deal with the feeders for the Eltham scheme.

FORTHCOMING EVENTS.

Friday, November 18th.—At 8 p.m. Junior Institution of Engineers. Presidential address by Mr. H. Lindley, of Frankfort-on-M., on "Municipal Engineering on the Continent."

North-East Coast Institution of Engineers and Shipbuilders. Meeting at Newcastle.

At 7.30 p.m. Institution of Electrical Engineers (Manchester). Opening meeting at Grand Hotel. Chairman's address, followed by a smoking concert.

Saturday, November 19th.—North-East Coast Institution of Engineers and Shipbuilders (Graduates). At Newcastle. Mr. R. A. Pringle on "The Application of Electricity to the Driving of Machinery."

Institution of Electrical Engineers (Leeds). Visit to Messrs. W. T. Glover's works and the L. & Y. Railway, Formby power station.

Monday, November 21st.—By 9.20 train ex Euston. Junior Institution of Engineers. Visit to the South Staffordshire Mond Gas Co.'s works and the Birmingham Corporation Gas Works.

Wednesday, November 23rd.—At 8 p.m. Faraday Society. "Recent Investigations bearing on the Theory of Electrolytic Dissociation," by Prof. L. Kahlenberg; "The Potential of the Hydrogen-Oxygen Cell," by Mr. F. J. Brislee.

At 7.30 p.m. Institution of Electrical Engineers (Birmingham). Address by Dr. W. E. Sumpner, chairman.

At 8 p.m. Society of Arts. "The Systematic Promotion of British Trade," by Mr. B. H. Morgan.

Friday, November 25th.—At 7.30 p.m. Institution of Electrical Engineers (Manchester Students). "Electric Power in Machine Shops," by Mr. H. C. Jenkins.

At 5 p.m. Physical Society. Meeting at the Royal College of Science.

Saturday, November 26th.—At 7.30 p.m. Glasgow Technical College Scientific Society. "The Electrical Drive of Large Reversing Engines working Intermittently," by Mr. M. Georgi.

Tuesday, November 29th.—At 7.30 p.m. Institution of Electrical Engineers (Manchester). "Compensated Alternating Current Generators," by Mr. Miles Walker.

NOTES.

Action against the Glow Lamp Syndicate.—The Vienna firm of Watt & Co. has instituted legal proceedings, in order to secure a declaration of invalidity in regard to the agreement which binds the constituents of the International Incandescent Lamp Syndicate, which carries on business as a German company domiciled in Berlin. The firm base their case on the statement that it has come to their knowledge that they have been misled in one of the most important points in the agreement, as a secret agreement existed between the Siemens & Halske Co. and the Allgemeine Co., whereby the latter was given special privileges in respect of the allotted production. In consequence of this the syndicate agreement is being attacked as invalid, partly on account of the alleged misleading, and partly owing to the operation of the Austrian coalition law. It appears, from the second clause of the syndicate agreement, that members are entitled to enter into an arrangement among themselves in regard to deliveries of less than the total of their respective allotments. During the negotiations preceding the actual foundation of the syndicate, the Siemens and Halske Co. claimed an equal allotment to that demanded by the Allgemeine Co.; but, as the former's plant could only be developed gradually, the company transferred to others, including the Allgemeine Co., the transitive lamp deliveries which it was unable to fulfil. This situation of affairs gave rise to the preparation of the before-mentioned second clause. The official transfer from the lamp company to the Siemens & Halske Co. took place about half a year after the formation of the syndicate, and the Vienna firm supports its action on this ground.

South African Notes (from our Durban correspondent).—*Cape Town* (*Cape Colony*).—Messrs. Nuttall & Co., of Cape Town, have applied to the Corporation for electric power for driving the machinery at their quarry, and agree to keep the plant working all day in three shifts, provided charges are made to suit them. The Committee recommends that energy be supplied at 4d. per unit, "flat rate," on condition that a minimum monthly total of 4,300 units is consumed, and all future consumers are to participate similarly.

Port Elizabeth (*Cape Colony*).—The report of the acting Cape Government electrician on the proposed Port Elizabeth electric lighting scheme is just issued. He considers that 220—440 volts supply is best adapted to the needs of the case. He comments on the adoption of Lancashire boilers, which, being 30 ft. long, will increase their landed cost on account of the freight. He considers the Parsons steam turbine a risky experiment, and suggests local difficulties in effecting repairs. He further considers the 400 KW. sets as small, and the drawing-in of cables in conduits an unnecessary refinement.

Durban (*Natal*).—Notice is given in the *Gazette* of an application by Cecil Francis Parr, of No. 4, Bartholomew Lane, London, for leave to introduce a Bill into the next session of Parliament to authorise him to construct, lay down, and thereafter work, either by electricity or other power, a tramway connecting on the south bank of the river Umgeni, with the tramways of the Corporation of the borough of Durban, thence across the bridge to be erected across the river Umgeni, and along the Government and private roads to Prospect Hall. The Bill will also ask for authority to supply electric light or electric power to residents in the districts concerned, and to acquire, by compulsory purchase if need be, such lands as may be necessary for the construction of the tramway.

East London (*Cape Colony*).—The Municipality is advertising a proposed Bill, giving it power to borrow the sum of £350,000 for municipal improvements, of which £1,250 is provided for tramway extension in St. George's Road, and £3,325 for extension at North End. Also the sum of £1,500 for electric light extension in Quigney, and £1,500 for Arcadia.

The Stalybridge, Mossley, Hyde and Dukinfield Joint Electricity and Tramways Scheme.—In connection with the illustrated description of the above scheme which appeared in our last week's issue, we "unwittingly" omitted to mention Messrs. Witting, Eborall & Co., who, as contractors for the whole of the switchgear, and the sub-station plants, with the exception of the batteries, may justly claim to have carried out a most important and interesting section of the undertaking. In this class of work, the firm in question has been very successful, as may be judged from the many illustrated descriptions of polyph..se plant appearing from time to time in the pages of the ELECTRICAL REVIEW. We are also asked to add that the auxiliary surface condensing plant supplied by the Sir Hiram Maxim Co. was made by the Mirrlees Watson Co., Ltd., who were sub-contractors for this work.

Peat Fuel in Ireland.—From the *Irish Builder and Engineer*, we note that there is a peat fuel factory at Monasterevan, County Kildare. Peat litter is made from the upper drier portions of the peat land, and from the lower parts a peat fuel block is being made. We have no particulars of the method of manufacture or drying, but a sample block, which measures 6 in. × 3½ in. × 2 in., is hard, heavy, and dry, and we should say fully as dense as coal. As there is no sulphur, and very little ash, the calorific capacity should be high for this dry material. We believe no claims are made for anything mysterious in the manufacture, which has been put on foot by private endeavour. There is an enormous tonnage of peat in Ireland, and it should be possible to garner this and turn it into good fuel by sound mechanical methods. At Monasterevan there is no handling of the peat, the process is mechanical except the first cuttings. A steady supply of fuel of the kind seen by us, ought to enable local industry to obtain a firm footing, for there are millions of tons of potential fuel all over Ireland. It is unfortunate that in too many cases, impossible and extravagant claims have been made for peat fuel production, and even electricity has been dragged in to support one process. No such claims are made for the peat fuel at Monasterevan, where a modest, but sound, industry seems to have been fairly started. With water carriage it ought to be possible to sell this peat in England at less cost than Welsh anthracite. In Ireland it should be an excellent fuel for gas producers. It is tough and resilient, and perfectly clean to handle, and should stand carriage well, without the formation of small or dust. Indeed, it is almost like hardwood in this respect.

The Electrical Standardising, Testing and Training Institution.—Prof. C. A. Carus-Wilson, M.A., M.I.E.E., was to commence a special course of lectures to the senior students of the above Institution yesterday, November 17th, upon "Direct-Current Motor Construction."

Trade Secrets.—A case which was heard in the Vacation Court recently is calculated to turn the attention of every employer to the question whether he can prevent his workmen disclosing trade secrets. In the case in question, the correspondence clerk of Messrs. Gamage, having left their service, entered into the employment of another gentleman in a similar line of business, to whom he proceeded to disclose lists of customers, with a view to their being canvassed. The new employer, upon finding out the true facts dismissed this servant, and Messrs. Gamage obtained an injunction to restrain him from making any surreptitious use of information acquired while in their employment. A number of cases have established that where a relation exists between two parties which involves the performance of certain duties by one of them, and the payment of reward to him by the other, the law will imply, or the Court may infer a promise by each party to do what is to be done by him. It follows from this that the Court, in interpreting a contract of service will look not only at the actual terms of the agreement but at what is implied therein. Thus it is generally understood that if a man undertakes to work for another he will devote his whole time and energy, not to the furtherance of his own interests, but for the benefit of his employer. The law will apparently interpret every contract of service in accordance with this doctrine. But it goes further, and will restrain a servant who has been discharged, or whose term has otherwise come to an end, from taking advantage of information which he may have unlawfully acquired in the time when his whole energies should have been devoted to his master. These are the principles which guided the Court in the case under review, and they would apply with equal force to every kind of employer and workman. For instance, suppose a man employed by a supply company were to leave their service. If he subsequently entered the service of a rival corporation and made use of information acquired by him in his former service, and in doing so injured the first company, they might obtain an injunction to restrain him.

I.E.E. (Dublin Section).—The opening meeting of the session was held the 10th inst. when the opening address, which we abstract in this issue, was given by Mr. Mark Ruddle, city electrical engineer, chairman of the section. Prof. Thrift, Messrs. Sheardown, C. J. Cummins, E. A. Aston, and W. Tatlow, hon. secretary, in criticising the address, were unanimous in regard to the need of more suitable primary and secondary education for those intended for the profession.

Northampton Institute.—Lord Reay will deliver the prizes at the Northampton Institute for the session 1903-4, on Friday, December 9th. The prize delivery will be followed by a conversazione, which will be continued on Saturday, December 10th.

Electrical Contractors and Corporation Employés.—Some correspondence has recently passed between the West Hartlepool electrical engineering and contracting firms, and the Corporation respecting the action of certain employés of the Corporation electrical department who have been working for the Corporation during the day, but have been doing electric wiring work for private consumers at night, making their own charges for the same. This the contractors protest against, saying that the work should have been left to them. The Town Clerk replied that it was not the practice of Corporation employés to do this, and that the only work so done had been carried out at the request of customers to connect up short lengths of wire to meters. The Corporation agrees that it is not desirable that their workmen should, "except in any such small matters," undertake the work of wiring. We understand that this reply is not considered satisfactory by the electrical firms, and the matter has been referred to Mr. Tweedy Smith, the hon. solicitor of the National Association of Electrical Contractors.

The Bastian Mercury Vapour Lamp.—Of the several problems which confront the electrical engineer of to-day, probably that of providing a commercially reliable electric lamp for side-street lighting is the most pressing. Both electrical and gas engineers are engaged in solving the matter, the latter superseding, in some cases, the dingy naked gas flame by incandescent lights, which, however, in exposed positions, can hardly be classed as reliable. For the former, the Bastian Lamp Co. are now pushing the claims of their mercury vapour lamp, which appears to be one of the most promising means of illuminating side streets. We have recently had an opportunity of inspecting some 24 of these lamps, which are being supplied to the Midland Railway Co. for use in their Bradford goods yard. The earlier form of this lamp was described in the Electrical Review of April 1st last; the present type is suitable for burning on 220 volts, and is provided with a zig-zag mercury tube in place of the earlier straight type. The lamps are rated at 140 c.p. (70 to 80 watts), and are guaranteed for three months. Similar lamps have been successfully tried in the St. Pancras streets, when they ran some 2,500 hours, and were taken down unimpaired, the standards used having been provided for an arc lighting scheme. The lamps are compactly built, and specially adapted for fixing in existing standards. The portion of the lamp which will eventually require renewing, *i.e.*, the mercury tube, can be replaced in a matter of minutes, and if simplicity combined with the well-known efficiency of the mercury vapour lamp, in a practical form, is any index of the suitability of a lamp for street lighting, we believe that Messrs. Bastian can claim a premier position for their latest production.

Comparative Cost of Water Power.—The cost of water power development in France, according to Prof. Janet, varies from $21.40 per horse-power to $150 per horse-power, depending on the head to be dealt with, the lowest expenditure being upon a fall of 140 metres in Haute-Savoie, the horse-power being calculated at the turbine shaft. At Geneva, for the first group of turbines erected, of 840 H.P., and for the river works then completed, the capital cost amounted to $300 per effective horse-power. The groups of turbines subsequently erected cost but $95 per horse-power, and the completed works would cost but $135 per horse-power. At the chlorate works at Valorbe, the capital expenditure upon the development of 3,000 H.P. amounted to only $19.45 per horse-power. At Niagara, the rates charged to ordinary consumers by the Cataract Power and Conduit Co. varied from 2 cents per unit for 1,000 units per month or less to 0.64 cent per unit for 80,000 to 200,000 units per month. The cost of energy for power purposes from water-power stations in France and Switzerland varied from 2.1 cents per unit for small powers to 1.24 cents per unit for large powers.—*Franklin Institute Journal.*

Alternating Currents of High Frequency.—Mr. Ernest Ruhmer, of Berlin, describes in the *Mechaniker* a new and very simple process for the production of currents of high frequency. Following are some details as given by the German inventor: The new machine for giving high frequency currents consists essentially of a circular steel plate resting on two supports (or even of a brass plate covered over with steel bands), as well as of an electro-magnet arranged radially in connection with the plate, and placed as near this latter as possible. The steel disk can take a rapid rotary movement under the action of an electric motor. When this device is to be employed, the disk is first made to turn completely and very slowly, but only once. The periphery of the disk in question is thus polarised, under the influence of the electro-magnet, which has been fed during this time with alternating currents of a usual frequency. The same as in the case of the Poulsen telegraphone, the magnetic impressions remain on the steel surface, and thus there are produced very simply, on the periphery of the disk, a series of positive and negative poles which succeed one another in a quantity which could not be realised by the hand, even in placing several very small electro-magnets beside one another. Once the disk has thus developed a magnet field containing a large number of poles very near one another, there can be drawn from the bobbin of the above electro-magnet, in submitting the steel disk to a rapid rotary movement, alternating currents of a very high frequency. By suitably constructing the electro-magnet, frequencies up to 50,000 per second can be obtained. This device constitutes a very interesting and practical application of the principle of the telegraphone.

The "Bleaching" of Flour by Electro-chemical Treatment.—J. N. Aslop has described a process for treating flour, in revolving cylinders through which ozonised air is passed under pressure, the effect being an increase of 12 per cent. in the amount of proteid present. The following analyses are given of a sample before and after treatment:—

	Before.	After.
Water	9·84	10·13
Starch, &c.	74·11	62 24
Proteids, &c.	14 99	26 71
Ash	0·44	0 20
Fat	0 62	0·62

Egyptian Electrical Trade.—It is announced that the British Engineering Co., of Egypt, Ltd., has been formed in Alexandria and Cairo, which should result in important electrical orders coming to this country, from that part of the world. The new company is a combination of a number of different British companies engaged in electrical manufacturing. It will act as agent for the following firms:—Dick, Kerr & Co., Ltd., Callender's Cable and Construction Co., Babcock & Wilcox, Gwynnes, Ltd., and Jas. Gibb & Co., Ltd.

The Resistivity of Milk.—As the experiments that have hitherto been made upon the electrical resistance of milk have not been carried out at a uniform temperature, the results are not altogether concordant; and, therefore, Herr F. Petersen has investigated the matter afresh, reporting the conclusions of his research in the journal *Die Landwirtschaftlichen Versuchs-Stationen* (1904, lx., 259). Apart from its composition, the resistivity of normal fresh milk is a function of the temperature at which it is examined, falling as the temperature rises, and *vice versâ*. The average value for milk from individual animals varies from 186 to 304 ohms at 15° C. The resistivity is affected by certain peculiarities in the animal giving the milk, which are not to be explained by the age or the period of lactation. Nevertheless, in old milch cows the resistivity diminishes very much during the last months of the lactiferous period. The resistivity of the colostrum of the first few days after calving is much below the normal; it then increases somewhat rapidly to the tenth or twelfth day, and finally falls again to the normal. The first milk drawn from a cow has always the smallest resistance, the resistivity increasing as the udder is emptied. The milk changes in composition by long standing in the udder, and this lowers its resistivity. Provided it does not turn sour, or alter in any other way, fresh milk does not change in resistivity on keeping. No difference is to be found in resistivity between the milk of grass-fed and stall-fed cows. No characteristic difference is to be found between the milks of cows of different breeds. Mixed milk varies in resistivity from 204 to 255 ohms at 15° C. An addition of water raises the resistivity of milk, but not to a sufficient extent to enable a small addition to be detected with certainty. Still, in doubtful cases, a determination of the resistivity may be useful in deciding whether water has been added. There is no direct relationship between the resistivity of milk and its "acidity" as measured with phenolphthalein. There is no direct relationship between the resistivity and the specific gravity or the total solids; but there is a certain proportionality between the resistivity and the amount of ash. The serum obtained by filtering milk through a porous earthenware filter contains all the constituents which render it a conductor of electricity; but when the salts are removed from milk, its conductivity almost entirely disappears. It is clearly the salts which confer conductivity upon milk, the most important substances being the chlorides, and then the phosphates and sulphates.

Electrolytic Deposition of Zinc on Iron.—Mons. J. Meurant, of Arlon, in Belgium, has taken out a German patent for an electrolytic process of "galvanising," the essential feature of which is that the bath contains a certain quantity of gum arabic in a state of solution. The liquid is prepared by mixing a solution of 1·5 kilos of sodium carbonate in 10 litres of water with 5 kilos of a 50 per cent. solution of zinc chloride. A second liquid is made up by dissolving 3 kilos of ammonium chloride in 20 litres of boiling water, and adding to it 6 kilos of gum arabic. The two liquids are next mixed together, boiled for a short time, diluted till they make 100 litres, and finally filtered. It is claimed on behalf of the gum arabic that it allows a very low voltage to be used in the galvanising process, a P.D. of 0·25 to 0·75 volt being sufficient. The deposit is also said to be very adhesive, so that the metal can be bent or drilled without causing it to chip off.

Electrolysis of Chlorides in Presence of Fluorides.—As mentioned in the Electrical Review for September 16th last, Siemens & Halske have taken out a patent for a process of producing chlorates from chlorides by electrolysis in presence of fluorides, which are stated to increase the yield. F. Förster and E. Müller have now investigated this process in order to see in what way the fluorides act. They find that in this particular case the fluorine compounds act in quite a different manner from that which has been observed by Skirrow and by Müller, increasing the yield of chlorate simply by the acid reaction they confer upon the electrolyte. A slight acidification of a chloride solution, by addition of a little acid, a bicarbonate, a bichromate, &c., encourages the secondary formation of chlorate, decreases the amount of hypochlorite, and reduces the anodic liberation of oxygen. Small quantities of fluorides increase the yield of pericdate from iodate, and of persulphate from sulphate during electrolysis; but the reason here is, according to Müller, that they raise the anodic potential of the platinum electrode.

Electrolytic Separation of Metals that Decompose Water from their Solutions.—As a result of some recent experiments, A. Siemens has found that magnesium can be deposited, together with nickel, from an aqueous solution. The concentration of the magnesium salt must be high, or the two metals will be separated. Cobalt can be used in place of the nickel. Aluminium and the alkaline earth metals cannot be deposited from aqueous solutions, together with heavy metals. Alkali metals, however, can be deposited in small quantities, together with nickel and tin. The products are not alloys of definite composition, but solid solutions of the light metal in the heavy one. With the exception of magnesium, aluminium, and beryllium (glucinum), the alkali and alkaline earth metals can be won by electrolysis of their salts when dissolved in acetone. Nickel magnesium sulphate does not yield any complex ions in aqueous solution.

Fatal Accident.—On Saturday night, whilst some workmen at the Pigeon House electric power station, Dublin, were raising a heavy fly-wheel by a crane to a top floor, they lost control of the crane handle, and the handle whirling round, struck one of them, John Hanley, in the stomach and hurled him to the basement, a distance of 25 ft., with fatal results.

Royal Society.—Among the papers down for reading yesterday were the following:—"Theory of Amphoteric Electrolytes." Part II. By Prof. J. Walker, F.R.S.; "The Electrical Conductivity and other Properties of Sodium Hydroxide in Aqueous Solution, as elucidating the Mechanism of Conduction," by W. R. Bousfield, K.C., M.P., and Dr. T. Martin Lowry. Communicated by Prof. H. E. Armstrong, F.R.S.

Technical Classes.—At the Paddington Technical Institute (London County Council), Saltram Crescent, W., classes are held in mechanical engineering, electrical engineering, mathematics and mechanics, physics, chemistry, mechanical drawing, &c. to which trade "apprentices" and "improvers" and others who are engaged in handicrafts as learners, are admitted free throughout, if they are under 21 years of age. The general fee to others is 10s. for the session of about eight months. This fee covers admission to as many classes as the applicant elects to join on entering.

Awards for Papers.—Among the prizes awarded by the Royal Scottish Society of Arts, Edinburgh, for communications read or reported on during the session of 1903-4 is a Keith prize to Basil A. Pilkington, for his paper on "An Apparatus for Maintaining Exact Temperatures Automatically by Electric Means"; a Hepburn prize to A. J. Pressland, M.A., F.R.S.E., for his paper on "The School Training of the Future Engineer"; and a Hepburn prize to Charles Norman Kemp for his paper on "Interrupters for Induction Coils, with Special Reference to the Recent Developments in Connection with Electrolytic Interruptors"; to Arthur W. Wynne, Assoc.M.Inst.C.E., for his paper on "Steam Turbine Machinery," a Macdougall-Brisbane complimentary medal; and to William Finlay, for his paper on "A Practical Description and Demonstration of the Pearson Fire Alarm," a Macdougall-Brisbane complimentary medal.

Appointments Vacant.—Chief engineer and manager for Leigh electricity undertaking (£250); turbine driver for Loughborough (30s.); shift engineer for Battersea (£104).

Photometrical Demonstration.—A demonstration of the latest forms of electrical and gas lighting apparatus, and a series of tests of the same, will be held at the Westminster Electrical Testing Laboratory from November 17th to December 19th. All who are interested will be supplied with tickets to visit the laboratory on application to Mr. L. W. Wild, chief electrician, at York Mansion, York Street, Westminster.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the power station or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*]

Central Station Engineers.—Mr. G. F. Booker, of the Mains Department at Croydon, was on Saturday last presented by Mr. A. C. Cramb, on behalf of the staff, with a set of technical books, on the occasion of his leaving Croydon to take up duties as assistant mains superintendent under the St. Pancras Borough Council.

On Friday, the 11th inst., at the Newton Abbot electricity works, a presentation was made to Mr. P. Davian, who has resigned his appointment as chief assistant engineer. The presentation of an inscribed silver cigarette case was made by the resident engineer and manager, Mr. F. C. Pay, on behalf of the staff and employés of the works.

Mr. W. H. Allen has received an appointment as engineer and manager at the Loughborough electricity works, at £120 per annum. Mr. G. H. Saunders has been appointed chief assistant at £100.

Pontypridd Electrical and Tramways Committee has appointed Mr. J. E. Teasdale (chief assistant and deputy to Mr. Arthur Ellis, electric light and tramways engineer at Cardiff) as resident electrical engineer, at a yearly salary of £300.

Mr. G. Gordon Ede has resigned his position as shift engineer at the Tunbridge Wells Corporation electricity works.

Out of 96 applicants, Mr. Charles R. Woolley, of Brighton, has been appointed junior assistant at the Crewe Corporation electricity works.

Tramway Officials.—Pemberton U.D.C. has resolved to pay £287 to the electrical engineer, Mr. T. Partington, for extra services in respect to the tramways.

On Tuesday last week Mr. E. G. Love, superintendent of mains and overhead tramway equipment at Halifax, was the recipient of a marble clock from the staff and employés of the works, as a mark of their esteem, on the occasion of his marriage. Mr. W. M. Rogerson, borough electrical engineer, made the presentation.

A complimentary dinner was given to Mr. James Dalrymple in the Grosvenor Restaurant, Glasgow, on Monday evening, on the occasion of his appointment as general manager of the Corporation tramways.

The officials of the Huddersfield Municipal Tramways Department have presented a smoking cabinet to Mr. C. Womersley, who is leaving for Kilmarnock.

Two officials of the Glasgow Corporation Tramways have been offered, and have accepted, appointments under their old chief, Mr.

John Young, in London. They are Mr. James B. McKinnon, head of the time-table department, who has accepted an important secretarial position; and Mr. A. Agnew, chief motor instructor at Coplawhill depôt, who has been appointed to the electrical engineering staff of the Metropolitan Railways.

General.—The Committee of Chemical Arts of the French Société d'Encouragement of National Industry has decided to award the grand Lavoisier medal to M. Heroult, the learned engineer of the French Electro-Metallurgical Society. M. Héroult has earned a reputation for his scientific labours in connection, among other matters, with the metallurgy of aluminium and the electric furnace, and it is said that, in his experiments, he has been ably assisted by the French Electro-Metallurgical Society. The award of the Lavoisier medal is made every seven years by the Société d'Encouragement to the French or foreign author whose works have exercised the greatest influence upon French industry in the domain of chemical arts in the preceding six years. The most recent distinctions in this respect were conferred upon Osmond, in 1897; Solvay, in 1891; and Michel Perret, in 1885.

Indian Engineering says that Mr. Shannon recently arrived in Mussoorie to take Mr. Billinghurst's place as electrical adviser to the Mussoorie municipality, the latter having gone to Kashmir to draw up an electrical scheme there.

Mr. Rupert Hughes, B.A., who has been for the past two years in the New York office of the *Times*, has been appointed editor of the *Marconigram*, which is to be in future issued as a popular scientific monthly magazine in New York City. Mr. Hughes spent some years in London on the staff of the "Encyclopædia Britannica."

Mr. C. Orme Bastian writes to us as follows:—"It has come to my knowledge that a rumour has gained considerable currency, to the effect that I have terminated my connection with the Bastian Meter Co., Ltd., and I shall esteem it a great favour if you will grant me space in your columns to give this rumour an emphatic denial, as it is calculated to do me and my business serious damage. As a matter of fact, I and my relatives have considerably increased our holdings in the company during the last few months, and although I have nominally resigned the managing directorship, nevertheless, I take precisely the same active interest in the management as heretofore."

Messrs. Norman A. Thompson and J. Gordon Wilson, A.M.I.E.E, have just started as consulting electrical engineers, under the style of Thompson & Wilson, at 22, North Bridge Street, Edinburgh. We understand that Mr. Thompson, in his recent employment, served the Clyde Valley Electrical Power Co. as manager and resident engineer, whilst Mr. J. G. Wilson was for several years head electrical designer to Messrs. Siemens Bros.

We learn that Mr. W. B. Esson, M.Inst.C.E., M.I.E.E., late chief engineer and manager to Messrs. Johnson & Phillips, has commenced practice as consulting engineer and electrical expert at 1, Victoria Street, Westminster, S.W. Mr. Esson has held the post of chief engineer and manager to leading electrical engineering firms for 20 years, and has accumulated experience of exceptional value during that period; he is so well known to all branches of the profession that he needs no introduction, and we hope, as we believe, that having so well deserved success, he will command it.

Prof. Henry Adams, M.Inst.C.E., has recently retired from the City of London College, where for 35 years he has been head of the engineering department; he is, however, still continuing his practice as a consulting engineer at 60, Queen Victoria Street, E.C., where he has had offices for the last 25 years.

NEW COMPANIES REGISTERED.

British Electric Equipment Co., Ltd. (82,542).—This company was registered on November 11th, with a capital of £40,000 in £1 shares, to adopt an agreement with H. G. Nicholson, relating to the acquisition by the company of the business now carried on as the "British Electric Equipment Co.," to build, construct, purchase, lease or otherwise acquire railways, electrical and other tramways, telegraphs, telephones and other public works and conveniences in England or elsewhere, and to carry on the business of engineers, electricians, suppliers of electricity, rolling stock manufacturers, makers of cables, wires, lines, accumulators, and lamps, &c. The first subscribers (each with one share) are:—V. R. Nicholson, 13, Beverley Road, Colchester, engineer; H. G. Nicholson, Savoy Court, W.C., electrical engineer; T. Hawkins, Upleadon, Upton Road, Watford, engineer; L. H. Rosenheim, 2, Lime Street Square, E.C., merchant: W. E. Sammes, 11, Queen Victoria Street, E.C., secretary; J. R. C. Smith, 37, Walbrook, E.C., solicitor; and T. H. Holt, 5, Essex Court, Temple, W.C., shipbroker. No initial public issue. The first directors are H. G. Nicholson and V. R. Nicholson; qualification, £100; remuneration of chairman £50 per annum; of others £25 each per annum. Registered office, 11, Queen Victoria Street, E.C.

Hastings and District Electric Tramways Co., Ltd. (82,521).—This company was registered on November 9th, with a capital of £500,000 in £5 shares (50,000 preference), to adopt agreements (1) with M. S. Myers and C. Mendel, (2) with the Hastings Tramways Co., and (3) with Dick, Kerr & Co., Ltd., to construct, purchase, lease, or otherwise acquire light or other railways and tramways in Hastings or Bexhill or elsewhere, to obtain any orders or Acts of Parliament in connection with the same, and to carry on the business of tramways and railway proprietors and workers, electricians, mechanical engineers, contractors for public and other works, &c. The first subscribers are:—E. C. Morgan, 20, Sussex Mansions, S.W., retired merchant, 100 preference shares; C. Kitchin, 81, Avenue Road, N.W., Member Stock Exchange, 100 preference shares; J. Williamson, 3, Palace Houses, W., Member Stock Exchange, 100 preference shares; C. Mendel, 27B, Throgmorton Street, E.C., stockbroker, 100 preference shares; M. S. Myers, 27B, Throgmorton Street, E.C., stockbroker, 100 preference shares; F. Goetz, 41, Park Lane, W., gentleman, 20 preference shares; and H. Strauss, St. Kilda, Goldhurst Terrace, N.W., gentleman, 20 preference shares. Minimum cash subscription, 5 per cent. of the shares offered to the public. The number of directors is not to be less than three nor more than five; the subscribers are to appoint the first; qualification, £500; remuneration, £2,000 divisible up to December 31st, 1905; afterwards £1,000 per annum and a share in the profits, divisible.

Electric Power Development Co., Ltd. (82,504).—This company was registered on November 8th, with a capital of £25,000 in £100 shares, to carry on the business of suppliers of electrical power, proprietors of electric light, telephone, telegraphic and other works, generators, storers, and transmitters of electricity for all purposes, mechanical and electrical engineers, manufacturers of rolling stock, &c. The first subscribers (each with one share) are:—F. Priestman, 2, Princes Buildings, Newcastle-on-Tyne, colliery owner; J. H. Armstrong, St. Nicholas Chambers, Newcastle-on-Tyne, chartered accountant; B. Price, Oakland, Bromley Park, Kent, engineer; A. H. Finch, 2, Wardle Terrace, Newcastle-on-Tyne, engineer; J. H. B. Noble, Manor House, Newcastle-on-Tyne, barrister; G. B. Richardson, 1, Lambton Road, Newcastle-on-Tyne, shipbuilder; and Lord Armstrong, of Bamburgh and Cragside. Minimum cash subscription 5 per cent. of the shares offered to the public. The subscribers are to appoint the first directors; qualification, £500. Registered office, 57½, Old Broad Street, E.C.

Crawshay-Williams, Ltd. (82,486).—This company was registered on November 7th, with a capital of £6,000 in £5 shares, to carry on the business of motor-car, vehicle, and cycle manufacturers, electricians, engineers, suppliers of electricity, &c. The first subscribers (each with one share) are:—A. J. Williams, Coedymwstwr, Bridgend, barrister; L. Crawshay-Williams, Coedymwstwr, Bridgend, engineer; M. Williams, 39, Victoria Street, S.W., consulting engineer; A. G. Morrish, 48, Gresham Street, E.C., chartered accountant; W. Buckton, 37, Ladbroke Square, W., retired engineer; G. B. Williams, 5, Kensington Mansions, S.W., consulting engineer; and C. G. Hatherley, Cross Oak Road, Berkhampstead, engineer. No initial public issue. The first directors are W. J. Williams, L. Crawshay-Williams and M. Williams; qualification, £100; remuneration, £50 each per annum. Registered office, 48, Gresham Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

White, Jacoby & Co., Ltd. (52,494).—This company's annual return was filed on September 19th, when 3,207 shares had been taken up out of a nominal capital of £4,000 in £1 shares. £1 per share has been called up and paid on 860. 2,357 are considered as fully paid. Mortgages and charges: £1,500.

Halifax and Bermudas Cable Co., Ltd. (28,972).—This company's annual return was filed on October 13th, when the entire capital of £50,000 in 10,000 shares of £5 each, had been taken up. All the shares are considered as fully paid. Mortgages and charges: £54,700.

W. H. Allen, Son & Co., Ltd. (66,440).—This company's annual return was filed on October 5th, when 151,100 shares had been taken up out of a nominal capital of £200,000 in £1 shares. £1 per share has been called up on 1,100, and £1,100 has been received. 150,000 shares are considered as fully paid. Mortgages and charges: £58,000.

Ackroyd & Best, Ltd. (54,600).—Issue on October 12th of £1,000 debentures, part of series created March 3rd, 1904, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: C. T. Naylor, Dean House, Kilmeston, Alresford, Hants; and J. P. Humble, Threelands, Birkenshaw, Yorks. Previously issued of same series: £3,850.

Dick, Kerr & Co., Ltd. (63,407).—This company's annual return was filed on October 18th, when 61,000 preference and 52,000 ordinary shares had been taken up out of a nominal capital of £650,000 in 70,000 preference and 60,000 ordinary shares of £5 each. £5 per share has been called up on 53,000 preference, and £265,000 has been received. £300,000 is considered as paid on 8,000 preference and 52,000 ordinary. Debenture stock: £30,000.

Malaga Electricity Co., Ltd. (48,076).—This company's annual return was filed on September 15th, when the entire capital of £57,000 in 10,000 ordinary shares of £5 each, and 7,000 deferred shares of £1 each, had been taken up. £50,000 has been received in respect of the ordinary shares, and the deferred are considered as fully paid. Mortgages and charges: £44,738.

Bastian Meter Co., Ltd. (53,304).—Issue on October 20th of £2,500 debentures, part of series created April 21st, 1904, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital, subject to outstanding first mortgage debentures. No trustees. No previous issue of same series.

Electric Law Press, Ltd. (72,435).—Issue on October 6th of £140 first mortgage debentures, part of series created by resolutions of June 23rd and September 30th, 1903, to secure £500, charged on the company's undertaking and property, including uncalled capital. No trustees. Previously issued of same series: £100.

British Electric Traction Co., Ltd. (49,855).—This company's annual return was filed on September 15th, when 133,301 ordinary, and 156,437 preference shares had been taken up out of a nominal capital of £4,000,000 in 200,000 ordinary, and 200,000 preference shares of £10 each. £10 per share has been called up on 117,926 ordinary, and 137,500 preference shares, resulting in the receipt of £2,554,246, in addition to £1 10s. paid on three forfeited shares. £349,120 is considered as paid on 15,975 ordinary, and 18,937 preference shares. Mortgages and charges: £1,527,830.

British Continental Electricity Co., Ltd. (57,088).—This company's annual return was filed on November 4th, when 1,000 preference, and 906 ordinary shares had been taken up out of a nominal capital of £20,000 in 1,000 preference, and 1,000 ordinary shares of £10 each. £10 per share has been called up on 790 preference, and 756 ordinary shares, resulting in the receipt of £15,460. £3,500 is considered as paid on 210 preference and 150 ordinary. Mortgages and charges: Nil.

New Phonophone Telephone Co., Ltd. (44,654).—This company's annual return was filed on October 18th, when 5,111 ordinary, and 1,000 founders' shares had been taken up out of a nominal capital of £10,000 in 9,000 ordinary, and 1,000 founders' shares of £1 each. 10s. per share has been called up on 5,111 ordinary shares, resulting in the receipt of £2,555 10s. 1,000 founders' shares are considered as fully paid. Mortgages and charges: Nil.

Keighley Electrical Engineering Co., Ltd. (44,893).—This company's annual return, made up to October 4th, has been filed. 4,100 ordinary and 1,000 preference shares have been taken up out of a nominal capital of £10,000 in 8,000 ordinary and 2,000 preference shares of £1 each. £1 per share has been called up on 3,488 shares, resulting in the receipt of £3,488. £1,612 is considered as paid. Mortgages and charges: £3,000.

A. Reyrolle & Co., Ltd., electrical engineers, Hebburn-on-Tyne (70,210).—A memorandum of satisfaction in full of a debenture dated March 31st, 1903, to secure £5,000, has been filed.

Otto Electrical Manufacturing Co., Ltd. (80,263).—Issue on October 21st of a £500 debenture, part of series created January 22nd, 1901, to secure £5,000, charged on the company's undertaking and property, present and future, including unclaimed capital. Holder: J. Deakin, The Hall, Wormhill, near Buxton. No trustees. Previously issued of same series: £2,000.

ELECTRIC TRAMWAY ACCOUNTS.

Brighton Municipal Tramways.

We give herewith the returns of the Brighton Corporation tramways undertaking for the years 1903 and 1904. From these it will be seen that increased route mileage in use during last year has led to but a slight increase in the traffic record of 1903, while the averages per car-mile are adversely affected in every instance, and, as a result, the undertaking lost nearly a penny per car-mile on their last year's working. We gather that the Corporation have been exceedingly generous in the matter of tramway fares, and to this is attributed, in great part, the disappointing results. The deficiency, as a whole, amounts to £4,779, which is carried forward. Mr. T. B. Holliday is the general manager.

General Statement.

For year ending March 31st.	1904.	1903.
Length of route...	9 mls. 76 ch.	6 mls. 40 ch.
Total length of track	18 „ 7 „	—
Number of cars	50	40
Car-miles run	1,151,477	1,031,928
Passengers carried per annum... ...	10,999,046	10,432,528
Capital expended to date	£242,811	£205,042
Traffic receipts	£46,040	£43,469
Total receipts	£46,264	£43,700
Working expenses	£40,247	£31,615
Gross profit	£6,017	£12,085
Income per car-mile	9·64d.	10·11d.
Working expenses per car-mile ...	8·41d.	7·35d.
Interest and sinking fund per car-mile	2·22d.	1·84d.
Total expenses per car-mile	10 63d.	9·19d.
Profit or loss per car-mile	−·99d.	+·92d.
Cost of energy per car-mile	2·31d.	2·16d.
Average fare per passenger	1d.	1d.
Revenue per mile of route	£4,649	£6,723
Expenditure per mile of route ...	£4,044	£4,864
Total units used	1,774,000	1,578,639
Units used per car-mile	1·54	1·53
Percentage of working ex'es to receipts	87	72

Profit Statement, 1904.

Interest on loans	£7,200
Sinking fund	3,488
Expenses *re* Preston Road prov. order	108
Deficiency on year's working	−4,779
Gross profit	£6,017

CITY NOTES.

Eastern Extension, Australasia and China Telegraph Co.

Sir J. Wolfe Barry (chairman) presided on Wednesday at River Plate House over the sixty-second half-yearly ordinary general meeting of the above company, and in moving the adoption of the report, said the accounts were more encouraging than those submitted to the general meeting six months ago, when they suffered very considerably from reduced revenue and increased expenditure. The gross revenue for the half-year under review amounted in round figures to £300,000, against £265,000 for the corresponding period of 1903—an increase of £35,000. This comparison, however, was somewhat misleading, because the receipts for the past half-year included interest on investments amounting to £13,125, which in the corresponding period of 1903 was credited to the reserve fund; consequently, to arrive at a proper comparison of other revenue between the two periods, the amount of interest should be deducted from the £35,000, thus reducing the increase for the half-year to roundly £22,000. This satisfactory increase was not entirely due to increased traffic, a large portion of it having been obtained from contract work; but he was glad to be able to tell them that a distinct growth of telegraphic business was observable all over the company's system, particularly in the local traffics, which was a very encouraging sign. The working and other expenses amounted in round figures to £141,000 against £138,000 in the corresponding period of 1903, showing an increase of £3,000, which was mainly accounted for by their having had to increase the staff in China and elsewhere to meet traffic requirements. The net profit for the half-year was £143,378, and after adding to it the credit balance of £41,890 brought forward from the previous half-year, there remained an available balance of £185,269. The usual quarterly interim dividends of 2s. 6d. per share had been paid for the past half-year, and the balance of £110,269 carried forward to the current half-year. As would be seen from the accounts, the general reserve fund had been debited with £6,273, the cost of a further partial renewal of the Hong Kong—Foochow cable, and credited with £2,679, representing the value of picked up cable from the partial renewal of the Singapore—Batavia section. When he last had the pleasure of addressing them, he mentioned that the directors were considering the advisability of re-arranging the company's maintenance facilities, and that the cable-ship *Restorer* might not be sent back to her former station at Adelaide. Circumstances had since arisen which had enabled them to sell the *Restorer* to the Commercial Pacific Cable Co., to replace the *Scotia* lost off Guam a few months ago. They had purchased and sent out to Singapore a small steamer named the *Magnet*, for effecting repairs to the many cables which the company possessed in shallow waters of less than 400 fathoms. By these means it was expected that a considerable economy would be effected in the maintenance of ships' expenses. The subsidy arrangement made with the French Government many years ago for establishing and maintaining cable communication between Saigon and Tonquin having expired last February, negotiations were entered into for a new arrangement, with the result that an agreement was arrived at, subject to Parliamentary approval, by which the French Government would acquire the ownership of the Tonquin cable. The agreement was expected to come before the Chamber of Deputies for ratification very shortly. The much talked-of conference that was to have been held long ere this to consider, among other questions, the effect upon the Pacific cable of the agreement entered into with the company by the Government of New South Wales and others, had again been postponed. Meanwhile the ratification of the agreement between the Federal Government and the company was in abeyance, but the arrangement by which the company was allowed to have direct dealings with the public in Melbourne remained undisturbed. The competition, however, between the two rival routes was being carried on as actively as ever, but so far the company had succeeded in maintaining their position, notwithstanding the unfair treatment accorded to them by the Governments interested, and to which he had on former occasions fully alluded. Results of the traffic of Australia showed each year more completely that no commercial necessity existed for the Pacific cable, which involved a loss to the various Governments of between £90,000 and £100,000 a year, and a serious loss to the company by the abstraction of traffic under the influence of the various Governments.

The Marquis of Tweeddale seconded the motion, which was agreed to without discussion.

The Typewriting Telegraph Corporation.

Mr. Arthur J. Parker presided at the meeting held at Winchester House on Monday. He moved the adoption of the report for the year ended September 30th, 1904, which showed a loss of £2,434. The report stated:—

The results of the trading of this corporation from its inception show that, outside the General Post Office, there is no public market in the United Kingdom open for the instruments, and that the present business with that department is insufficient to support the corporation. On the other hand, the fact is established that there is an increasing but slow demand for our instruments for examination and testing by the War and the Post Offices of several Governments. The reports to hand in nearly every case have been satisfactory, and some important experiments now in progress have yet to be reported upon; your directors have no reason to believe that they will fail to be favourable. The financial position of the corporation is such that liquidation is inevitable unless a sum of about £4,000 is raised at once. It is estimated that with this sum the corporation will be able to carry on business for two years, and fully exploit and prove the value of the "Standard Keyboard Teletyper," for which the corporation possesses the sole licence for the United Kingdom.

There seem to be but three courses open to the shareholders:—(1) To raise money by the issue of preference shares or debentures; (2) reconstruction; (3) winding up the corporation, and selling stock, patents and other assets for what they will fetch.

On these three courses the directors offer the following comments:—As to the first course, it would not be possible to raise money in this way, unless those putting up the money were to receive large interest and priority as to capital—say, £4,000 10 per cent. debentures issued at 85, or cumulative preference shares with priority as to capital carrying a higher rate of interest. This course would be the most economical method if it could be carried through. The security available for these advances consists of the stock of instruments, &c., the British, foreign and colonial patents, and the sole licence for the United Kingdom for the sale of the new standard keyboard teletyper, which promises to be valuable. As to the second course—viz., reconstruction—this would clearly entail considerable legal expense. As to the third course, winding up and selling the assets, the difficulty would be to find a purchaser for these *en bloc*.

If the shareholders support the new syndicate (respecting which particulars were sent out on August 4th last), arrangements might be made for selling to the syndicate the patent rights and the stock of the corporation for fully-paid shares.

The Chairman, after briefly going over the chief figures in the report, said that the directors, in placing a plain and frank statement before the shareholders, had fulfilled the promise which was made on January 15th, 1903. There was very great difficulty in regard to the sale of the foreign patents, and if the company were to liquidate to-day enormous loss would be entailed, but, if shareholders had patience, the board would realise the assets to the best of their ability. He went on to show that the working expenses had been greatly reduced, but the profits from the trade, as at present developed, were not large enough to pay the expenses. The progress that was being made in pushing the sale of the instruments in European and other countries was then referred to in great detail, showing that the business was not quite such a dead horse as it seemed a few years ago. The prospects of success in the military world were good. With the Post Office their position with the old instrument was not so promising, but they thought that in the new keyboard teletyper they had the right thing. They wanted time to realise the assets and money to carry on for a couple of years, and if success did not come within that time, he should say it never would come, and they should liquidate. The value of the stock if put up to auction would be nothing. To throw away £5,000 worth of good instruments in that way would

be madness. They required £3,000 to continue, and to exploit the new instrument. Since the issue of the report they had been relieved of liability for their lease, and had hopes of more speedily realising blocks of their instruments, so that they could reduce the estimate of £4,000 to £3,000.

Mr. R. W. Nash seconded the adoption of the report, and after a long discussion, it was carried.

An extraordinary meeting followed, at which the question of raising debentures or liquidating forthwith was discussed at great length. Ultimately the proposal of the board to try to raise £3,000 of 10 per cent. debentures at 85, in lots of £10, was adopted by a majority.

Prospectuses.

The prospectus of the *Llandudno and Colwyn Bay Electric Traction Co., Ltd.*, has this week been before the public in connection with the offer by the Welsh Electric Traction Co., Ltd., of 1,000 5 per cent. first mortgage debentures of £50 each, and 49,440 ordinary shares of £1 each at par. The nominal capital of the company is £150,000 with a debenture issue of £60,000. Some 10,560 shares have already been issued for cash. The Llandudno and Colwyn Bay Company, Limited, as owners of certain light railway orders, have power to construct a tramroad to connect these two popular holiday resorts, which it is stated are visited by about 500,000 persons during the year. The route authorised by the order is approximately 8½ miles long, and extends from near Colwyn Bay station, through the rising residential district of Rhos, between the golf links and the shore, to Penrhyn Bay, and along the main road to the West Parade, Llandudno. A contract for part of the line between Rhos Road and the North-Western Hotel, Llandudno, is let, and the work is being vigorously proceeded with in order to have it completed and opened for traffic by March 1st, 1905. A report as to the prospects of the company and its probable income has been prepared by Mr. Stephen Sellon, the well-known authority on electric tramways, and a copy of his report was issued with the prospectus. Mr. Sellon states that, based on past experience, together with his intimate knowledge of the district, the net earnings of the company should be £13,300 per annum, which would provide the interest on debentures (£2,500), and leave a surplus of £10,800 per annum. The construction contracts provide for a portion of the contract price being paid in shares or debentures. Arrangements are made for the supply of power by the local authority. The list of applications opened last Saturday, and was to close on Thursday (yesterday). The consulting engineers to the company are Messrs. J. M. Hewitt, of Manchester, and Dr. W. G. Rhodes, M.I.E.E., also of Manchester. The offices are at 33, Brazennose Street, Manchester (Mr. John Morris, secretary).

The Hastings and District Electric Tramways Co., Ltd., is inviting subscriptions until Monday next for £125,000 4½ per cent. debenture stock, and 25,000 6 per cent. cumulative preference shares of £5 each. A construction contract has been entered into with Messrs. Dick, Kerr & Co., at cost price plus 15 per cent, and the firm is willing to take a large proportion of its price in preference shares and temporarily in debenture stock. The length of the proposed system is 19½ miles.

Western Union Telegraph Co.

The annual report of this company for the year ended June 30th, 1904, states that the revenue for the year was $29,249,390 (£5,849,878), being an increase over 1903 of $81,703 (£16,340). Expenses amounted to $21,361,915 (£4,272,383), being an increase of $408,700 (£81,740). After providing for interest on bonds, there remain $6,729,775 (£1,345,956). Of this sum $4,868,071 (£973,614) has been appropriated for dividends, leaving a surplus of $1,861,703 (£372,340) for the year, increasing the total at date to $14,881,428 (£2,976,285). Nearly $100,000 (£20,000) was expended in connection with the repairs to the company's trans-Atlantic cables. The net growth of the plant in poles and cables was 2,833 miles; in wires 66,193 miles, and in offices 338. The company now owns altogether 1,155,405 miles of wire. $2,465,779 (£493,156) was spent in the construction of new lines.

South Lancashire Electric Traction and Power Co.—Holders of first debenture stock of this company are required to produce their certificates and particulars of their claims to the liquidators of the company by December 2nd, pursuant to a judgement of August 16th. Fuller particulars regarding the matter appeared in the *London Gazette* for November 11th.

Nernst Electric Light Limited and Reduced.—The petition for reducing the capital according to the scheme already approved by shareholders, &c., comes before the Court (Mr. Justice Swinfen Eady) on November 29th.

Stock Exchange Notice.—Application has been made to the Committee to appoint a special settling day in and to grant a quotation to Bath Electric Tramways, Ltd., £135,000 4½ per cent. first mortgage debenture stock.

West India and Panama Telegraph Co.—A dividend of 7s. per share is declared on account of arrears on the first preference shares.

STOCKS AND SHARES.

Wednesday Evening.

Save for a sharp outburst of speculation in Anglo-American Telegraph stocks, the electrical sections have passed a fairly quiet week. Business in all the markets slackened upon circulation of vague apprehensions regarding the political outlook. The anxiety as to fresh Russian complications exercises a restraining influence upon general financial trade, although the eager subscription to the new Japanese Loan shows that the public has plenty of money available for putting into attractive investments of the speculative order. There has been a further movement in the direction of narrowing official quotations to prices that more nearly represent dealing margins, but for the practice to be thoroughly carried into effect almost every price in the succeeding pages should be again overhauled by the dealers in the Stock Exchange responsible for the quotations.

As already mentioned, the Anglo-American Telegraph Co.'s group is the principal feature of strength. The Ordinary and Preferred stocks have risen four points each, and after wild fluctuations—the price having been as high as 14½—the Deferred this Wednesday afternoon left off at 12¼, a jump of 2⅜ per cent. Several theories are afoot to account for these improvements, but all lack certainty. It is, however, manifest that much of the buying is on behalf of an American clique, and there appears to be some slender ground for the suggestion that the company's capital may be reconstituted in rather different form. We would also recall the fact, to which attention was drawn here a few months ago, that the time is approaching when the renewal fund having reached a million pounds, the payments now made to it every year will be turned towards the dividend account of the Deferred stock. Direct United States have risen a modest ¼ to 10⅜, and advances of ¼ are shown by Globe Telegraph and Trust of both kinds. A rise of ¼ took Eastern Extensions to 13, and Western Telegraph shares have more than recovered their dividend of 5s. Some of the lower-priced issues are better, West India and Panama in particular, a 3/16 jump leaving them at 1 1/16, while the first Preference mark ¼ rise at 7¼. West Coast of America, favourably affected by the Anglo boomlet, came into notice at 7/16, which is slightly better, but Submarine Cables Trust certificates have eased off a little to 119. A fall of ¼, too, occurred in Great Northern Telegraphs, upon the latest international fears, and the price is now 28½. Callender's Ordinary are in demand at 9⅜, a rise of 5s.

Of the telephone descriptions, United River Plate Preference at 5¼ exhibit the fraction improvement. Chili Telephones maintain their better level, and the only National Telephone issue to show alteration is the Deferred, which, at 97, is ½ lower.

Home Railway steam stocks were considerably shaken in the early part of the week upon the publication of a few poor traffics, but the electrical rails kept steadily good. Central London Ordinary rose 2 to 94, the Preferred 1 to 102, while the Deferred is a little better at 85. East Londons have had their annual spurt, thanks this time to the electrification rumours, and the Ordinary stock shot up to 6¼, after being 6⅝. The company's prior charges are also harder. Districts at 42½ have barely moved, and Metropolitan Consolidated is unchanged at 101. Great Northern and City Preferred are 5⅜.

Traction shares continue somewhat featureless. Anglo-Argentine Trams keep good at 7 and 5 7/16 for Ordinary and Preference respectively, and Buenos Ayres and Belgrano "A" shares rose to 5⅝, the "B" remaining at 5¼, and the Ordinary being 1/16 down at 3 15/16. Buenos Ayres Electric Trams (1901) Debenture is 97½, and City of Buenos Ayres shares are 10⅜. At 10 13/16 London United Tramways Preference are better, and the Debenture stock was done on Tuesday at 105 and 105¼. The rise in Metropolitan Electric Tramways 4½ per cent. Debenture still continues, and the quotation is now up to 104. Calcutta Trams changed hands at 7 11/16, and British Electric Traction Preference fell ⅛ to 11½. Capes are 1 1/16.

Three only amongst the Lighting shares have any alteration to show. Charing Cross Preference at 5⅛ are ⅛ harder, and rises of ¼ are credited to County of London Ordinary at 9½, and Metropolitans at 16¼. The cause of the former is the success of the recent Debenture issue. Brush Ordinary weakened to 1⅛, and Cromptons now go out at 1½—1⅝ in the *Official List*. On the other hand, a narrower margin makes 1/16 rise in Electric Constructions, and British Aluminium Preference rose ¼ to 6, the Debenture stock, allowing for deduction of the dividend, being 1½ better. South Wales Power shares have eased off to 8½, but the Debenture stock is hard at 108, and a preliminary inspection of the coming report shows that the company occupies a capital position.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	Name.	Stock or Share. ‡	Dividends for the last three years. 1901.	1902.	1903.	Closing Quotations Nov. 9th.	Closing Quotations Nov. 16th.	Business done week ended Nov. 16th, 1904. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	99 —102	99 —102	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2½— 3	2½— 3	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	.. — ..	.. — ..	..	..
788,840	Anglo-American Telegraph	Stock	61s.	60/6	61s.	52 — 54	55 — 58	58	58½
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	99 — 102	103 — 105	105¼	99½
3,105,580	Do. do. do. Deferred	Stock	2s.	1/-	2s.	9⅜— 10	12⅛— 12⅜	14⅜	9⅝
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	6 %	7 %	5⅜— 5¾	5⅜— 5¾	5 13/16	5 5/16
13,888,800$	Commercial Cable	$100	8 %	8 %	..	170 —190	170 —190	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	93 — 96	93 — 96	95	..
16,000	Cuba Telegraph	10	4 %	6¼%	5 %	7½— 7¾	7½— 7¾	7⅞	7 1/16
6,000	Do. 10 % Pref.	10	..	..	..	14½— 15½	14½— 15½	..	..
6,000	Direct Spanish Telegraph10 % Cum. Pref.	5	..	..	..	7½— 7¾	7½— 7¾	..	..
80,000	Do. do. 4½ % Debs.	50	..	..	..	99 —101	99 —101	..	..
60,710£	Direct United States Cable	20	3½%	3½%	3 %	10⅜— 10⅝	10⅜— 10⅝	10⅝	10⅜
81,800	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,200, Red.	100	..	..	..	100 —102	100 —102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	133 —136	133 —136	135	133½
1,955,565	Do. 8½ % Pref. Stock	100	..	..	..	88 — 90	88 — 90	88⅞	..
1,534,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	105 —107	105 —107	106⅛	105
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	12⅝— 12⅞	12⅝— 12⅞	13	12⅝
820,000£	Do. 4 % Deb. Stock	Stock	..	..	..	106 —108	106 —108	..	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 8,000, red. 1909	100	..	..	..	101 —103	101 —103	..	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	100 —102	100 —102	..	..
180,227	Globe Telegraph and Trust	10	5½%	£3 16 7*	5½%	9⅜— 9⅞	9⅜— 10	10	9⅜
180,042	Do. do. 6 % Pref.	10	..	..	..	13⅜— 13¾	13⅜— 14	13⅞	..
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	12½%	15 %	28½— 29	28¼— 28¾	..	..
54,700	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	100 —102	100 —102	..	..
17,000	Indo-European Telegraph	25	10 %	10%	10 %	44½ — 46½	44½ — 46½	44½	..
72,680	Monte Video Telephone Co., Ltd., Ord.	1	2½%	3 %	3 %	⅜— ⅝	⅜— ⅝	⅜	..
1,998,333	National Telephone, Pref. Stock	100	5 %	6 %	6 %	106½—107½	106½—107½	107½	107
1,966,667	Do. do. Def. Stock	100	..	4½%	5 %	97 — 98	96½— 97½	97⅝	96½
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 14	13 — 14	14	13
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 13	12 — 13	..	..
2,250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5½— 5⅝	5½— 5⅝	5⅝	5½
000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	97½— 98½	97½— 98½	98½	..
689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	104½—105½	104½—105½	105½	104⅝
1,000,000	Do. do. Prov. Certs., 85 % to be paid	..	..	..	..	67½— 68½	67½— 68½	..	..
179,313	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	6¼%	1/16— 1/8	1/16— 1/8	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	..	..	..	1⅛— 1¼	1⅛— 1¼	1¼	1⅛
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	98 —100	98 —100	..	..
11,889	Reuter's	8	5 %	5 %	..	6⅞— 7¼	6⅞— 7¼	..	..
8,908	Submarine Cables Trust	Cert.	..	..	..	118 —121	118 —120	..	..
58,000	United River Plate Telephone	5	7 %	7 %	..	6⅜— 6⅝	6⅜— 6⅝	6⅜	6 7/16
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4⅛— 5⅛	5⅛— 5⅜	5 5/16	5¼
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	104 —106	104 —106	..	..
15,609	West African Telegraph, Shares	10	..	2 %	4 %	7 — 7½	7 — 7½	..	..
30,009	West Coast of America, 1 to 30,000 and 53,001 to 53,009	2½	..	..	..	1/16— 3/16	⅛— ¼	..	..
150,000£	West Coast of America, 4% Debs., 1 to 1,500 guar. by Brss. Sub. Tel.	100	..	..	..	98 —100	98 —100	..	..
207,990	Western Telegraph, Ltd., Nos. 1 to 207,990	10	7 %	7 %	7 %	13 — 13½	13½— 13⅝	13½	13
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	101½—103½	101½—103½	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	101½—103½	101½—103½	..	..
98,321	West India and Panama Telegraph	10	..	..	..	7/16— 9/16	7/16— 9/16	9/16	..
84,563	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	6⅞— 7⅛	7⅛— 7⅜	7⅛	..
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	5¼— 5½	5¼— 5½	..	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,600	100	..	..	..	101 —103	102 —104	103½	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

90,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	5½— 6	5⅝— 6¼	..	..
10,000	Do. do. "A" 6 % Cum. Pref.	10	..	..	..	5⅝— 9¼	8¼— 9¼	..	..
800,000£	Do. do. 5% 1st Mort. Deb. Stock Red.	Stock	..	..	..	96 — 100	96 — 100 xd	..	..
100,000	British Electric Traction	10	9 %	8 %	..	9⅞— 10⅛	9⅞— 10⅛	10	9 13/16
100,000	Do. do 6 % Cum. Pref.	10	..	..	..	11⅛— 11⅜	11 — 11⅛	11 5/16	11 1/16
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	117 —119	117 —119	118½	118
	Do. do. 4½% 2nd Deb. Stock Red.	100	..	..	..	95 — 97	94 — 97	96½	96
100,000	British Insulated and Helsby Cables	5	10 %	10 %	8 %	5¼— 6	5¼— 6	..	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5¼— 6	5¼— 6	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	101 —104	101 —104	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	..	..	9/16— 11/16	9/16— 11/16	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	..	..	14/6 to 15/6	14/6 to 15/6	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	½— ¾	½— ¾	..	..
150,000	Do. do. Non-cum. 6 % Pref.	2	3 %	6 %	6 %	1 — 1⅛	1 — 1⅛	..	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	93 — 96	93 — 96	..	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	69 — 73	69 — 73	..	..
85,000	Callender's Cable Construction shares	5	20 %	15 %	12½%	9½— 9¾	9½— 10	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5 — 5⅛	5 — 5⅛	..	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	104 —106	104 —106	105	104⅞
1,850,014	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	91 — 94	93 — 95	94	93⅛
494,093	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	100 —102	101 —103		
494,993	Do. do. Def. do.	Stock	4 %	4 %	4 %	83 — 86	84 — 86	85	84⅜
1,330,000	City and South London Railway	Stock	2 %	3½%	2⅜%	46 — 47	46 — 47	47	46
85,000	Crompton & Co., Nos. 1 to 85,000	8	7½%	5 %	..	1½— 2	1½— 2	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	90 — 95	90 — 95	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £8 paid, 1 to 99,261	5	Nil	Nil	..	½— ¾	½— ¾	..	..
17,139	Do. do. "A" shares, 01—017,139	5	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..
344,023£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	78 — 83	78 — 83	..	..
100,000£	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	..	..	..	79 — 84	79 — 84	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	6 %	4 %	1 — 1⅛	1⅛— 1⅛	..	..
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	..	..	..	2 — 2⅛	2⅛— 2⅜	..	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	98 —100	98 —100	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	9½— 10	9½— 10	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	91 — 96	91 — 96	..	..
200,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	15 %	10⅜— 11⅛	10⅜— 11⅛	..	..
200,000	Do. do. 4½ % Pref.	5	..	..	..	5⅝— 5⅞	5⅝— 5⅞	..	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	109 —111	109 —111	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	20 — 20½	20 — 20½	20 1/16	..
800,000£	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	99 —102	99 —102	..	..
97,500	†Liverpool Overhead Railway, Ord.	10	1¼%	1¼%	..	8⅜— 8⅝	8⅜— 8⅝	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10 — 10½	10 — 10½	..	..
37,850	Telegraph Construction and Maintenance	12	20 %	20 %	20 %	37 — 39	37 — 39	38⅞	38⅝
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	102 —104	103 —104	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3½%	3½%	88 — 90	88 — 90	89	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (April 21st, 1904).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*).— ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME.	Stock or Share.	Dividends for the last three years 1901.	1902.	1903.	Closing Quotations Nov. 9th.	Closing Quotations Nov. 16th.	Business done week ended Nov. 16th, 1904. Highest.	Lowest
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	£ 5	8%	8 %	10 %	10½ — 11	10½ — 11	10 7/16	..
20,000	Do. do. 7 % Cum. Pref. ..	5	..	..	..	10½ — 10¾	10½ — 10¾	..	..
250,000	Central Electric Supply 4 % Guar. Deb. Stock	100	..	..	..	106 —109	106 —109	..	..
50,000	Charing Cross and Strand Electricity Supply	5	10 %	10 %	8 %	8½ — 9	8½ — 9	..	..
70,000	Do. do. do. 4½% Cum. Pref.	5	..	..	..	5⅜ — 5⅝	5⅜ — 5⅝	5½	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref.	5	..	..	..	4½ — 5	4½ — 5	..	..
40,000	Do. do. 1903	5	..	..	..	4½ — 5	4½ — 5	1⅛	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	103 —105	103 —105	..	..
44,436	*Chelsea Electricity Supply, Ord.	5	4 %	4½%	5½%	6¼ — 6¾	6¼ — 6¾	6 11/16	..
150,000£	Do. do. % Deb. Stock Red.	Stock	..	..	..	109 —111	109 —111	..	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595 ..	10	5 %	5 %	5 %	10½ — 11	10½ — 11	10⅝	..
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	..	..	..	13¾ — 14	13½ — 14	13⅝	..
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid ..	£	..	..	..	128 —127	128 —127	124	..
800,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid ..	100	..	..	..	104 —106	104 —106	104½	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4 %	9 — 9½	9½ — 9⅝	9 7/16	..
20,000	Do. do. do. 6 % Pref., 40,001—60 ..	10	..	..	..	12 — 12⅝	12 — 12⅝	..	..
430,000£	Do. do. 4½% Deb. Stock	£	..	..	..	106 —109	106 —109	108½	107½
250,000	Do. do. 4½% 2nd Deb. Stock	Stock	..	..	..	101 —103	101 —103	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	7 %	6¼ — 6⅝	6¼ — 6⅝	6 3/16	6 5/32
70,000	Do. do. 6 % Cum. Pref.	£	..	..	..	5⅞ — 6⅛	5⅞ — 6⅛	..	..
300,000£	Do. do. 4½% 1st Mort. Deb. Stock ..	100	..	..	..	106 —108	106 —108	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	12%	12 — 13	12 — 13	..	..
90,000	Do. do. do. 4 % Debenture Stock ..	Stock	..	..	..	102 —104	102 —104	102½	..
110,000	London Electric Supply Corporation, Limited, Ord.	3	..	..	..	2 — 2⅛	2 — 2⅛	2⅛	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	5⅝ — 5⅞	5⅝ — 5⅞	..	..
250,000£	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	97 — 99	97 — 99	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6½%	7½%	8½%	15⅞ — 16⅛	16 — 16⅛	16 5/16	16⅛
71,106	Do. do. 4½% Cum. Pref. 1—71,106, £3 paid ..	5	..	..	..	5⅞ — 6⅛	5⅞ — 6⅛	5 15/16	..
220,000£	Do. do. 4½% 1st Mort. Deb. Stock	£	..	..	..	112 —117	112 —117	..	..
250,000£	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	97 — 99	97 — 99	97½	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	6 %	14½ — 15	14½ — 15	..	..
59,000	Do. do. 4% 1st Mort. Deb.	100	..	..	..	101 —103	101 —103	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½ — 14¾	14½ — 14¾	..	..
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	..	..	..	8⅝ — 9	8⅝ — 9	..	..
150,000£	Do. do. do. 3½% Deb. Stock Red ..	100	..	..	..	99 —101	99 —101	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	..	2½%	4 %	2⅞ — 3⅛	2⅞ — 3⅛	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	..	..	..	83 — 87	83 — 87	..	..
65,000	South London Electricity Supply, Ord.	5	..	1½%	3 %	4⅛ — 4¼	4⅛ — 4¼	..	..
100,000	South Metropolitan Electric Light and Power (*Late Blackheath and Greenwich Dist. E.L.Co.*) Ord.	1	..	..	..	⅞ — 1	⅞ — 1	..	..
50,000	7 % Pref.	1	..	..	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	1⅜	..
100,000	4½% 1st Deb. Stock	100	..	..	..	107 —110	107 —110	108½	..
30,000	Urban Electric Supply, Ord.	5	..	..	..	4⅞ — 5	4⅞ — 5	5	4⅞
30,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4 15/16 — 5 1/16	4 15/16 — 5 1/16	5 1/16	..
200,000	Do. do. 4½% 1st Mort. Deb. Stock Red	100	..	..	..	103 — 105	103 —105	104½	104
110,000	Westminster Electric Supply, Ord.	£	10½%	12 %	13½%	12⅝ — 13⅛	12⅝ — 13¼	13 1/16	13
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6¾ — 6⅞	6¾ — 7	..	..

* Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, November 16th.

CHEMICALS, &c.

		Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 5	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a ,, (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£21	..
a Lead, Nitrate	per ton	£25	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90% a 160° C).	per gal.	5/6	..
a Potash, Bichromate, in casks ..	per lb.	8d.	..
a ,, Caustic (75/80%) ..	per ton	£24	..
a Shellac	per cwt.	240/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Crystals	per ton	£8	..
a ,, Bichromate, casks	per lb.	2½d.	..

METALS, &c.

b Aluminium Ingots, in ton lots ..	per ton	£180	..
b ,, Wire, in ton lots ..	per ton	£168	..
b ,, Sheet, in ton lots ..	per ton	£166	..
b Rabbitt's metal ingots	per ton	£48 to £140	..
Brass (rolled metal 2° to 15°, basis	per l	7¼d.	5d. inc.
c ,, Tube (brazed) ..	per lb.	9½d.	¼d. inc.
c ,, ,, (solid drawn)	per lb.	8¾d.	⅜d. inc.
c ,, Wire, basis	per lb.	7¾d.	¼d. inc.
c Copper Tubes (brazed)	per lb.	10d.	¼d. inc.
c ,, ,, (solid drawn) ..	per lb.	10¼d.	¼d. inc.
c Copper Bars (best selected ..	per ton	£78	£2 inc.

METALF, &c. (*continued*).

		Latest Price.	Week's Dec. or Inc.
g Copper Sheet	per ton	£78	£3 inc.
g ,, Rod	per ton	£78	£2 inc.
e ,, (Electrolytic) Bars ..	per ton	£69	£3 inc.
e ,, Sheets ..	per ton	£85	£3 inc.
e ,, ,, Rod ..	per ton	£79	£3 inc.
e ,, ,, H.C. Wire	per lb.	9d.	¼d. inc.
f Ebonite Rod	per lb.	8/8	..
f ,, Sheet	per lb.	8/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha fine	per lb.	8/-	..
h India-rubber, Para fine	per lb.	5/- to 5/2	inc.
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	45/3	4½d. dec.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 ..	per ton	£9 15	..
g Lead, English Ingot	per ton	£13 5s. to £13 7 6	..
g ,, ,, Sheet	per ton	£11 17s. 6d.	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£7 15	..
d Mica (in original cases) small ..	per lb.	6d. to 1/	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/2½	..
p ,, rolled bars & rods	per lb.	1/- to 1/3	..
p ,, ,, strip & sheet	per lb.	From 1/1	..
o Platinum	per oz.	£4	..
e Silicium Bronze Wire	per lb.	9d. to 11d.	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i ,, ,, in bars		£15 to £40	..
g Tin, Block	per ton	£132 10 to £133	10s. dec.
g ,, Foil	per lb.	1/6	..
m ,, Wire, Nos. 1 to 16	per lb.	1/8½	½d. inc.
p White Anti-friction Metals— "White Ant" brand ..	per ton	£42 to £62	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	8d.	..
j ,, 6 lea. Flax	per lb.	5½d.	..
j ,, 8 ply 10 lbs. Russian ..	per lb.	4½d.	..
j ,, 10 lbs. Russian, single ..	per lb.	4½d.	..
j ,, 180 lbs. Jute rove ..	per ton	£11	..
k Zinc, Sh'ts (Vieille Montagne brd.)	per ton	£27 17 6	10/- inc.

Quotations supplied by Messrs.:—*a* G. Boor & Co.; *b* The British Aluminium Co., Ltd.; *c* Thos. Bolton & Sons., Ltd.; *d* F. Wiggins & Sons.; *e* Frederick Smith & Co., *f* India-Rubber, G.P. and Teleg. Works Co., Ltd.; *g* James & Shakspeare; *h* Edward Till & Co.; *i* Bolling & Lowe; *j* Walter H. Hindley and Co., Ltd.; *k* Morris Ashby, Ltd.; *m* W. T. Glover & Co., Ltd.; *n* P. Ormiston & Sons; *o* Johnson, Matthey & Co., Ltd.; *p* The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Week ending	Receipts for the week. £	£*	No. wks.	Total to date. £	£*	Miles open.	*
Aberdeen	Nov. 12	1,120	+ 46	24	36,346	+ 5,713	10	—
Bath	,, 9	553	—	46	29,105	—	12½	—
Birmingham ..	,, 12	5,584	+363	46	247,941	+13,588	8½	—
Blackburn	,, 11	826	+ 76	32	31,854	+ 3,173	18½	—
Blackpool	,, 10	337	+ 38	32	41,467	+ 5,860	8½	—
,, —Fleetw'd	,, 12	185	— 37	19	20,059	+ 372	7½	—
,, —Lytham	,, 10	145	— 15	—	198	—	7½	+ ¾
Bolton	,, 6	1,694	+ 7	32	59,944	+ 874	25	—
Bournemouth ..	,, 9	827	— 31	32	37,436	—	10½	—
Bradford	,, 5	3,946	+420	31	147,718	+25,692	58½	—
Brighton	,, 13	897	+ 13	—	35,032	—	9	—
Bristol	,, 11	4,634	— 86	—	—	—	28	—
Devonport ..	,, 4	496	— 44	44	23,751	+ 3,335	5	—
Dudley—Sto'rb'ge	,, 4	781	+ 12	44	38,725	+ 1,426	18½	—
Gateshead ..	,, 4	893	— 55	44	40,190	+ 1,344	10½	+ ¾
Gr'n'k—Pt. Glsgw	,, 4	523	+ 17	44	25,685	+ 1,293	7½	—
Oldham—Ashton	,, 4	524	— 18	44	24,358	— 1,017	8	—
Potteries	,, 4	1,801	+109	44	75,706	+ 5,538	28½	—
South Staffs. ..	,, 4	748	—286	44	34,033	— 6,484	21½	—¾
Swansea	,, 4	484	— 7	44	24,164	+ 1,011	5½	—
Wolverhampton ..	,, 4	353	— 4	44	17,337	— 74	10½	+8
Yorks. Wool Dists.	,, 4	512	— 55	44	26,088	+ 8,760	6	—
Miscellaneous ..	,, 4	2,944	—	44	161,089	—	—	—
Burnley	,, 12	1,008	+212	—	—	—	10½	+2½
Burton-on-Trent ..	,, 6	310	—	31½	11,418	—	8½	—
Cardiff	,, 12	1,902	+ 37	32	67,580	+ 1,664	14	—
Chatham & District	,, 10	526	+ 17	45	26,727	+ 2,206	9·53	—
Cork	,, 10	425	— 12	45	21,317	— 2,552	9·99	—
Dover	,, 12	181	+ 16	45	9,976	— 260	8	—

Locality.	Week ending	Receipts for the week. £	£*	No. wks.	Total to date. £	£*	Miles open.	*
Dublin	Nov. 11	4,546	+ 44	—	100,371	— 3,029	47	—
East Ham	,, 12	618	+ 6	32	24,165	+ 1,485	6½	—
Glasgow	,, 12	14,314	+ 590	24	344,860	+19,091	72½	+6½
Halifax (2 weeks) ..	,, 2	2,628	+ 82	31	48,271	+ 3,598	34½	+1½
Huddersfield ..	,, 12	1,260	+ 87	32	45,114	+ 2,907	28	—
Hull	,, 12	2,154	+258	32	71,419	+ 9,411	13	+2
Ilkeston	,, 9	121	+ 15	32	4,730	—	3·5	—
Ipswich	,, 12	373	—	32	16,739	—	10½	—
Isle of Thanet ..	,, 12	331	+ 39	45	39,165	+ 1,647	10½	—
Leeds	,, 12	5,402	+296	92	194,676	+11,721	89½	+8½
Liverpool	,, 5	10,143	+ 248	45	467,488	+13,241	103	—
London C. C. ..	,, 2	13,867	+3486	31	378,879	+80,028	47½	+7½
Manchester	,, 12	11,788	+473	32	400,192	+17,215	137½	+12½
Newcastle	,, 12	3,576	+ 2	—	—	—	17	—
Portsmouth	,, 12	1,554	+159	—	67,709	+ 5,532	14½	—
Salford	,, 7	3,997	+130	31	131,121	+ 7,990	30	—
Sheffield	,, 6	4,471	— 6	32	151,559	+ 2,919	34½	+1½
Southampton	,, 10	899	— 7	32	32,811	— 2,160	16½	—
Southend-on-Sea ..	,, 9	236	+ 13	32	12,921	+ 1,337	6½	—
Sunderland	,, 6	1,117	+ 23	31	41,266	+ 720	21	+1
Tyneside	,, 9	335	+ 41	45	17,725	+ 2,980	8·9	+ ·4
West Ham	,, 10	1,047	—	37	34,818	—	9·78	—
Wolverhampton ..	,, 9	717	—292	—	—	—	9·5	—
Cen. London Rly. ..	,, 12	7,002	+ 6	19	117,861	— 272	6	—
City & S. Lon. Rly.	,, 13	2,841	— 53	20	49,812	— 1,847	6½	—
Dublin—Lucan Rly.	,, 11	96	— 9	19	2,561	— 17	6½	—
G. N. and City Ry.	,, 12	1,268	—	39	39,103	—	3½	—
L'pool Overh'd Rly.	,, 13	1,409	—227	20	31,982	— 1,612	6½	+4½
Mersey Railway ..	,, 12	1,459	+138	19	27,772	+ 2,253	4½	—

* Compared with the corresponding period of 1903.

TEST ON 500-KW. CURTIS TURBINE SET AT CORK.

In view of the great attention given by engineers to the performance of steam turbines, we think that the publication of a series of tests carried out on a 500-kw. continuous current Curtis steam turbine set at the Cork Electric Tramway and Lighting Co.'s station, which was supplied by the British Thomson-Houston Co., Ltd., of Rugby, may be of interest.

These tests were conducted by Mr. Charles H. Merz, the consulting engineer to the company. The object of the test was to ascertain the steam consumption at varying loads, and for this purpose five tests were made—at quarter-load, half-load, three-quarter load, full load, and 25 per cent. overload respectively. The tests were generally of 1½ hours' duration, although the last test, at 25 per cent. overload, was slightly under one hour. Great care was taken in each case that, before the test was commenced, all conditions of load, &c., should be absolutely steady.

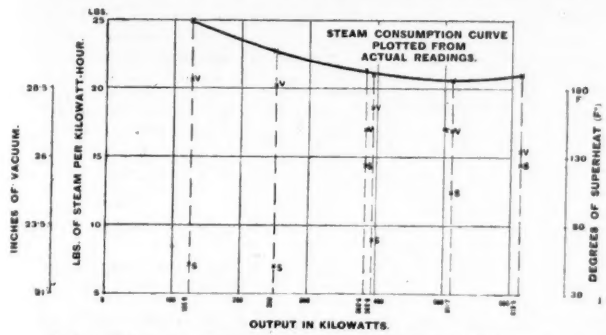

STEAM CONSUMPTION CURVE PLOTTED FROM ACTUAL READINGS.
LBS. OF STEAM PER KILOWATT-HOUR.
INCHES OF VACUUM.
DEGREES OF SUPERHEAT (F.)
OUTPUT IN KILOWATTS.

Fig. 1.—Steam Consumption Curve Actually Obtained.

The tests were started by taking a reading of the watt-hour-meter, and by commencing to fill the water tank, and 3 minutes after the start ammeter and voltmeter readings were taken. Six minutes after the first watt-hour-meter reading, a second reading was taken, and the condensed steam was weighed. Six minutes after the first ammeter and voltmeter readings, second readings of these instruments were taken, and so on. Hence all readings were taken every 6 minutes, the ammeter and voltmeter readings midway between the watt-hour-meter and condensed steam records.

A general summary of the results of the tests is given by the accompanying log-sheet. Steam consumption curves are also given.

The vacuum and superheat curves used in making the corrections were those published in *Engineering* on February 5th, 1904.

RECENT ADVANCES IN APPLIED ELECTRO-CHEMISTRY.

A report upon the advances which have been made during the past year in technical electro-chemistry from the pen of Prof. Dr. K. Elbs appeared in the *Chemiker-Zeitung* a short time ago, and from it we extract the following particulars.

Electro-Metallurgy.

Copper.—The total amount of electrolytic copper produced in the year 1903 was probably about 318,000 tons, of which the United States made 86 per cent., Great Britain 9 per cent., Germany 3 per cent., and France 2 per cent. During the previous year, from the 278,000 tons of pure copper manufactured in North America, some 800 tons of fine silver worth $13,000,000, and 7,500 kg. of fine gold worth $5,000,000 were recovered. G. Kroupa has found that American anode slime contains on an average 50 to 75 per cent. of silver, 0·014 to 0·686 per cent. of gold, and 10 to 40 per cent. of copper. The largest factories there turn out as much as 27 "wagon-loads" of copper per day, together with about 300 kg. of silver and 5 or 6 kg. of gold. The slimes are either worked up by furnacing, or in the wet way by extracting the silver and copper with sulphuric acid, and then decomposing the silver sulphate with metallic copper. The electrolytic processes which have been proposed for the treatment of copper ores have not proved satisfactory on the large scale, *e.g.*, those suggested by Höpfner and by Siemens and Halske.

Nickel.—A strictly electrolytic method of winning nickel from its ores has not been devised; but T. Ulke has worked out a process for separating nickel and copper, which is practicable, though not altogether new. An alloy, preferably consisting of about 80 per cent. of copper and 20 per cent. of nickel, is prepared from the ore, and used as an anode against a copper cathode in a bath of copper and nickel sulphates strongly acidified with sulphuric acid. The anode dissolves, fine copper falls at the cathode, and the bath gradually becomes stronger in nickel. A portion of the electrolyte is removed from time to time, and replaced by a solution of copper sulphate, which need not be pure, as long as it is rich in that metal. From the liquid which has been withdrawn, either the copper is precipitated as sulphide, or the nickel as nickel ammonium sulphate, the nickel being thrown down electrolytically from its ammoniacal solution by means of lead anodes. Borchers and Günther have suggested a similar process, and have proposed that during the electrolysis of the nickel, white lead or chrome yellow should be made by the Luckow method. For the refining of nickel, D. H. Browne uses a hot solution of nickel chloride containing common salt at the works of the Canadian Copper Co., which were removed from Cleveland some time ago to be erected on a larger scale elsewhere.

Mercury.—The only novelty to be recorded is the proposal of H. Becker's to obtain the metal by distilling a mixture of cinnabar and chalk in the electric furnace.

Zinc.—S. S. Sadtler has proposed to obtain a liquid by acting upon a mixture of zinc and zinc sulphide with a strongly alkaline solution of sodium hypochlorite, from which pure zinc may be won by electrolysis. The idea does not appear very promising. A. Salgués has suggested the treatment of zinc ores in the electric furnace, and the process is in operation in the Ariège. No technical opinion has been passed upon it, but in view of the great heat losses in the ordinary metallurgy of zinc, Salgués' process may well prove successful.

Log Sheet.—Test of 500-kw. Curtis Turbine.

Particulars of test.		Ammeter readings.		Standard voltmeter readings.	Average load during test in kw.		Total units used throughout test.			Average units.	Total water lbs.	Water per kw.-hour lbs.	Vacu'm inches.	Steam pressure lbs.	Superheat °F.	Speed revs. per min.
Load	Duration.	Standard.	Switchboard.		Standard.	Switchboard.	Standard.	Switchboard.	Watt-hour meter.							
¼	1½ hrs.	234	224·5	549	128·5	123·25	191·75	184·9	208·26	196	4,879	24·9	28·8	155	51	1,835
½	1½ „	460·7	453·65	547	252	248·12	378	372·2	—	375	8,400	22·64	28·6	155	50	1,820*
¾	1½ „	718·5	718·8	548	393·7	393·9	590·5	590·8	—	590·65	12,377	20·95	27·8	153	70	1,822*
Full	1½ „	922·5	921·4	555	512	511·4	768	767	760	764	15,755	20·6	26·9	153	104	1,820
1¼	54 min.	1,244	1,235	495	615·8	611·3	554·2	550·17	544	552	11,530	21	26·2	151	124	1,800

* Watt-hour-meter not connected.

The weight of condensed steam was measured by a tank and weighbridge, which was tested before and after the test, and found to be accurate. Vacuum gauges were connected to the low-pressure chamber of the turbine, and to the body of the condenser; these gauges were in agreement. Under conditions of full load, however, the vacuum registered in the turbine exhaust chamber was 2 in. lower than that registered in the condenser, showing that the pipe connection from the turbine to the condenser was not sufficiently large. The barometric pressure throughout the test was 30·16 in.

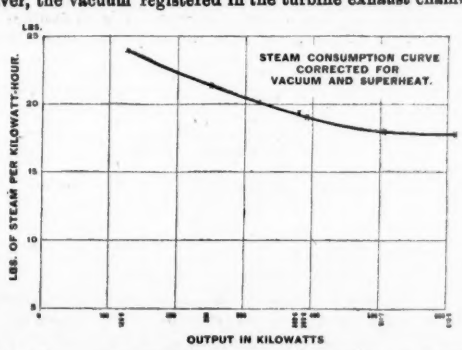


Fig. 2.—Steam Consumption Curve Corrected to 28·66 in. Vacuum and 115° Superheat.

The output of the machine was measured by two ammeters, a standard voltmeter, and a watt-hour-meter. The figures entered on the log-sheet appended are the mean figures of all readings at each load, readings being taken every 6 minutes. The readings given are the readings corrected after each instrument had been carefully recalibrated against a standard in the Newcastle-upon-Tyne Electric Supply Co.'s test house.

Iron.—Stassano has an arc furnace running in upper Italy, upon the pure ores found there, which is showing a thermal efficiency of over 60 per cent. The furnace is one of 500 H.P., taking an alternating current of 2,000 amperes at 170 volts, and giving an arc 1 metre long. At present the yield has the qualities of Martin steel, but by further improvements it seems possible that a crucible steel may be obtained. Keller is using two superposed furnaces, the upper one being a resistance furnace in which the ores are reduced, and the lower one being employed for refining the metal. At La Praz, Héroult is obtaining tool steel of the best quality by smelting a mixture of cast-iron and steel scrap in a furnace shaped like a Bessemer converter, with the aid of two alternating arcs of 4,000 amperes at 60 volts; the output per run being three tons. A similar furnace is being erected in Sweden on the railway between Granbergsdal and Kortfors. Kjellin is making crucible steel of the best quality at Gysinge in Sweden, in a furnace which contains no electrodes. An alternating current of high tension, but small in volume, is led to the furnace, which acts, with the molten metal in it, as a step-down transformer. The charge consists of 1 ton of a mixture of charcoal iron, and mild steel. This furnace is running regularly, and enlargements of the plant are contemplated. The electrical smelting of iron ores can only be successful commercially where coal is dear, water power present, and the ores are good and cheap; but, on the other hand, it appears as if steel may be profitably made electrically alongside the blast furnace, the dynamos being driven by gas engines fed with the waste gases from the blast furnaces.

Potassium.—A method has been worked out by Lorenz, Clark, and Sacher for avoiding the trouble usually experienced from the vaporisation of the potassium at the temperature of the bath. Dry caustic potash is fused in an iron vessel and electrolysed between a sheet-iron anode and a cathode of iron wire. The latter passes through the bottom of a hollow inverted cylinder of magnesite, the mouth of which dips below the surface of the electrolyte. When the cylinder is nearly full of metal, it is allowed to cool somewhat, plunged into petroleum, and broken. The current efficiency is about 58 per cent. Sodium can be advantageously made in a similar fashion, but not barium from its oxide. The process is not suitable for the electrolysis of chlorides, as the cylinder quickly becomes injured.

Manufacture of Compound Bodies in the Furnace.

Calcium Carbide.—Some of the carbide factories which are unable to find a market for their product, have introduced the manufacture of ferro-silicons containing from 25 to 75 per cent. of silicon; others, such as those at Landeck and Matrei, are producing silicon-copper containing from 35 to 50 per cent. of silicon. A more promising outlook for this industry lies in the preparation of calcium cyanamide (the production and utilisation of which has been frequently mentioned in past issues of the Electrical Review). When calcium cyanamide, $CaCN_2$, is treated with steam under pressure, it is decomposed into calcium carbonate and ammonia. When it is extracted with hot water, a white crystalline mass is obtained on cooling, which consists of dicyandiamide $(CN_2H_2)_2$; and when this is fused with sodium carbonate, the chief yield is sodium cyanide and ammonia. Small quantities of tricyantriamide $(CN_2H_2)_3$, or melamine, are also produced, but these can also be worked up into cyanide and ammonia. Calcium cyanamide is quite free from poisonous properties. As mentioned elsewhere, calcium cyanamide can either be prepared by heating previously-made calcium carbide to redness in presence of atmospheric nitrogen, or, in one operation, by fusing lime and coke in presence of nitrogen in the electric furnace. The former material contains about 20 to 22 per cent. of nitrogen; the latter about 12 to 14 per cent. Together with the process for making nitric acid elaborated by Ostwald, which consists in leading a mixture of ammonia and air over glowing platinum, and the partially successful method of causing the oxygen and the nitrogen of the air to unite under the influence of an electric spark, we have now means of preparing ammoniacal and nitric nitrogen compounds from the air, which will be ready for adoption on the large scale before the Chilian deposits of sodium nitrate are exhausted.

Siloxicon.—By heating silica and carbon in an electric furnace, Acheson has prepared a new material bearing this name, which appears to possess all the refractory and chemically indifferent properties found in carborundum. Its formula is C_2Si_2O, or C_7S_3O, and it is obtained when the amount of carbon in the charge is insufficient to ensure complete reduction of the silica, and at a lower temperature than that necessary for the formation of carborundum.

Manufacture of Compound Bodies, &c., by Electrolysis.

Hydrogen, Oxygen and Ozone.—At the present time some 28,000 tons of caustic potash, and 5,000 tons of caustic soda are being produced in Germany alone every year by electrolysis of their chlorides, and during the process 625 tons, or 7,000,000 cubic metres of hydrogen are evolved. This cannot be allowed to escape into the factories for fear of explosions, and it is usually led through pipes into the air, and blown to waste. Naturally the expenses of storing, compressing, and forwarding the hydrogen to a consumer are heavy; and in many places it may be cheaper to obtain the gas by direct electrolysis. Nevertheless, the hydrogen obtained as a by-product in the alkali works, might be more generally employed than it is. Since 1899 the works at Griesheim has been supplying all the hydrogen required for filling Count Zeppelin's air-ship (which holds 10,000 cubic metres); and the factory at Bitterfeld has sent its hydrogen to the military aeronautical department at Berlin. The laboratory at Griesheim also uses hydrogen instead of coal gas. The gas is so light, and diffuses at such high speed, that it is less likely than coal gas to form explosive mixtures with air when it escapes; besides which its flame is hotter, and containing no sulphur, it does not injure platinum crucibles, nor introduce errors into analytical results. The purification of potable water by means of ozone is fulfilling all expectations. An official report from the Department of Public Health states that the cost is 0·7 pf. per cubic metre.

Alkali and Chlorine.—A patent has been taken out by the Austrian Verein für Chemische und Metallurgische Produktion, of Aussig, which gives several details respecting the "bell" method of making caustic not previously published. It is stated that the anode carbon should nearly fill the bell, so that the fresh chloride solution run into it can only have a narrow space to flow downwards in, thus mixing more thoroughly with the rest of the anode liquid. There must be a certain fixed relationship (depending on the area of the bell) between the distance from the lower surface of the anode to the lower edge of the bell, and the amount of alkali in the cathode liquid which constantly flows away. O. Steiner has carried out some systematic experiments upon the same process. He finds that when run continuously, the bell process shows a current efficiency of 85 to 94 per cent., gives an alkaline liquor containing 120 to 130 grammes of KOH per litre, and a chlorine of 97 to 100 per cent. purity, and requires a current density of 2 to 4 amperes per square decimetre of horizontal bell area at a tension of 3·7 to 4·2 volts. Up to a maximum of 130 grammes of KOH per litre, the current efficiency is almost independent of the strength of the final liquor. Steiner also finds the statements made in the patent just mentioned, to be correct.

Hypochlorites.—The plan of adding the chloride of an alkaline earth metal to the chloride solution from which hypochlorites are to be made, has been known for some time; its efficacy depends on the formation of a film of hydroxide upon the cathode, which acts as a diaphragm, and diminishes cathodic reduction. Recently the company Vormals Schuckert & Co. have improved the idea by adding resin or a solution thereof to the electrolyte. There can be no doubt that it is cheaper to manufacture a certain quantity of "active" chlorine in the form of bleaching powder, as is done when caustic is made, than to install special electrolytic apparatus for the production of an equivalent amount of bleaching liquid from common salt according to the well-known methods. Nevertheless, the preparation of the latter liquid is simpler, cheaper and cleaner than the solution and filtration of bleaching powder, while the operation of bleaching with the liquid is more rapid, and generally more complete; hence the special apparatus is serviceable, and, indeed, preferable, for cotton and linen and in steam laundries.

Chlorates.—As it has been found desirable to keep the chloride solution slightly acid, Lederlin has patented a process for adding a small quantity of hydrochloric acid to the chloride bath at intervals; while Threlfell and Wilson have patented a plan of using a subsidiary cathode behind a diaphragm, and diverting a portion of the current to it, so that the liquid near the anode may be kept acid. The National Electrolytic Co. has a method of keeping the electrolyte at the necessary temperature by means of the current itself, and causing the liquid constantly to circulate outside the cell, where the chlorate is recovered by cooling and consequent crystallisation.

Permanganates.—The factory at Griesheim has an electrolytic process of manufacturing manganates or permanganates of alkaline earth, earth or heavy metals from the corresponding compounds of the alkalis and the respective chlorides, which give as by-products alkali, hydrogen, and oxygen or chlorine.

Persulphates.—According to Levi, alkali persulphates can be easily prepared without a diaphragm in the presence of some chromate. The liquid does not require such rigorous cooling, although above 30° C. the yield diminishes seriously.

Chromates.—The factory at Griesheim has patented two processes for the simultaneous manufacture of alkalis and alkali chromates. In one a salt solution is electrolysed with an anode of chromium or an alloy thereof; in the other a mixture of a chromium and an alkali salt is electrolysed with insoluble electrodes and a diaphragm.

Lead Compounds.—Ferchland has a process for making lead peroxide from an aqueous solution of the nitrate. Lead sponge separates at the cathode, lead peroxide at the anode, in coherent plates. The electrolyte becomes acid, and is neutralised by adding lead oxide or carbonate. The lead sponge is easily converted into oxide by heating it in air, and the oxide goes back into the bath. Hartmann has patented a modification of the Luckow method of making white lead, the utility of which appears doubtful. Instead of the lead cathode, which falls to pieces and contaminates the white lead with lead sponge, he proposes to employ a cathode of copper oxide, which is converted into metal, but remains coherent.

Organic Compounds.—Hofer and Moest have described (and the latter has patented) a process for obtaining alcohols by the electrolysis of aliphatic salts, in presence of perchloric acid with indifferent electrodes; sodium acetate, for instance, give up to 90 per cent. of the theoretical yield of methyl alcohol. A patent has been taken out for the reduction of nitrobenzene to azoxybenzene, by suspending the former in aqueous potash, using a large cathode and a small anode, without a diaphragm. At the boiling point Meister, Lucius and Brüning find that the yield is chiefly azobenzene. Boehringer and Söhne find that nitro compounds can be reduced to amines electrolytically when suspended in alkaline or saline liquids, as well as in acid ones, a copper cathode being employed, and powdered copper being added. When the amine is not attacked by the alkali, the yield is almost quantitative, and the process can, therefore, be combined with a production of free alkali and chlorine. According to a subsidiary patent, the cathode need not be of copper if powdered copper is used. Various other methods of preparing amines by electrolysis have been patented. During the past year 4,000,000 kilos of electrolytic chlorine were consumed in the manu-

facture of monochloracetic acid alone, this compound being employed in the synthesis of indigo.

The remainder of Prof. Elb's article is taken up with a brief description of such researches upon organic electrolysis as may possibly prove of industrial value, and it concludes with a review of recent methods for performing electrolytic analysis.

THE CONTINENTAL ELECTRICAL INDUSTRY.

It is reported that the Berlin Allgemeine Co. and the Lahmeyer Co. have been awarded contracts for the supply of plant for the municipal station to be established at The Hague. The direct current plant is to be delivered by the former company and the rotary plant by the latter works. In the turbine department, which the A.E.G. started with a dozen men in March last, the business has so largely increased that 1,100 employés are now at work. The orders on hand comprise turbines up to 5,000 H.P., and colliery owners are also said to be taking an interest in this type of engine. A regular interchange of experience and inventions is proceeding between the company and the General Electric Co., of New York. It is reported from Nuremberg that the Schuckert Co. will probably declare a dividend at the rate of 2 per cent. for the past year, as the net profits are estimated to amount to 2 per cent. No distribution took place a year ago.

A company is being promoted in Berlin for the purpose of establishing a service of electric cabs in that city. It is proposed to introduce 300 cabs, and to work them from eight stations, and it is said that similar schemes are in contemplation for London, New York, Paris and Vienna. The new undertaking is reported to be under the auspices of the Allgemeine Co., which is credited with the intention of constructing and equipping the cabs, while the batteries will be furnished by the Berlin-Hagen Accumulator Co., and an English firm is to introduce a new patent in connection with the vehicles. It is understood that the Accumulator Co. is making tests with special types of batteries which have been obtained from the United States for the purpose. The new company, the formation of which has not yet been confirmed, may possibly be based upon the New Automobile Co., which was established by the Allgemeine Co. in 1901.

The German Cable Works Co., of Rummelsburg, near Berlin, which was unable to make any distribution in the two preceding years, has returned to the dividend-paying stage for 1903-4. According to the directors' report, the gross profits amount to £38,127 as compared with £36,520 in 1902-3, and after providing for working expenses and depreciation, the net profits are £3,900 as against £7,273. It is proposed to pay a dividend at the rate of 3 per cent. on the share capital of £100,000, whereas the profits in the previous year were devoted to the extinction of the then existing debit balance. The report states that the prices of cables and insulated wires were kept at a low level owing to severe competition, and the trading results were also prejudicially affected by the extraordinary advance in the price of raw rubber.

The Cologne Co. for Electrical Investments, which underwent financial reorganisation in 1902 when the ordinary share capital was reduced from £750,000 to £500,000, has now been compelled to proceed with a fresh scheme of reconstruction, whereby the same class of capital becomes further curtailed to £350,000. This has been rendered necessary owing to the advisability of writing down by £204,060 the company's holding in the St. Petersburg Co. for Electrical Installations, and making provision for depreciation in other respects, which make the total sum to be wiped out amount to £280,088. The scheme, which is now being carried into effect, has absorbed the reserve funds, although the paper profits realised by the reduction in the share capital has allowed of the restoration of the amount to the legal reserve fund and the placing of £15,000 to the dividend reserve fund.

The accounts of Garbe, Lahmeyer & Co. (German Electricity Works), of Aix-la-Chapelle, show net profits for 1903-4 of £2,115, after having written off £9,653 for the purpose of depreciation, as against £6,076 provided for the latter purpose in the previous year. The profits have been disposed of by extinguishing the deficit brought forward from 1902-3, and by carrying the balance to the reserve fund. At the general meeting the prospects of the company for the current year were reported to be favourable.

The general director of the Helios Electricity Co., of Cologne, in reply to an inquiry as to the financial results of the past year's trading, is reported to have stated that a definite judgement cannot at present be given, as the work in connection with the preparation of the balance sheet has not yet been finished. However, it can be seen that a not inconsiderable loss will again be declared, as in consequence of unforeseen and inevitable circumstances, the business turnover has not been able to be brought up to the amount necessary to reduce the losses. The reports respecting endeavours to associate the company with competitors, the director concluded, are pure inventions. The above statement of the anticipated results for 1903-4 is surprising in view of the fact that the company underwent a system of financial reorganisation as recently as 1902.

The Berlin Electricity Works Co., which is the principal supply undertaking in the German capital, may be referred to on the present occasion on account of the large share which the municipal authorities receive out of the profits, which amount to approximately £450,000 for 1903-4, as compared with £400,000 in the preceding year. Out of the former total the sum of £142,314 will pass into the possession of the city, this being over £13,000 in excess of the amount paid by the company a year ago. This increase is due to the improved results which have attended the supply business in the past year, and which allow of an advance in the dividend from 9 per cent. to 9½ per cent. this year. It is now intended to increase the company's share capital from £1,260,000 to £1,575,000 for the purpose of extending the generating stations and mains.

The Compagnie Parisienne de l'Air Comprimé, which undertakes an electric lighting and compressed air supply in the French capital, has earned net profits of £231,000 in 1903-4 as against £212,000 in the preceding year. It is not intended, as on former occasions, to pay any dividend, but to transfer the surplus to the special reserve fund for the redemption of the invested capital. The adoption of this course is rendered necessary in consequence of the uncertainty surrounding the company's concession. Indeed, the Prefect of the Seine has intimated his intention of placing before the Paris Municipal Council early next year a scheme for the amalgamation of the electric lighting business in Paris, and thus make it unnecessary for any of the concessions to be renewed.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, which has a share capital of £1,000,000, and a bond issue of £400,000, is again unable to pay a dividend on the ordinary capital. This result was expected, as it was suggested at the last general meeting that the prospect existed of no distribution being possible for 1903-4. The accounts show net profits amounting to £12,550, as compared with £4,970 in 1902-3, and, after making provision for the reserve fund, the balance of £11,000 has been carried forward to the next account.

The United Electricity Co., of Vienna, which belongs to the group associated with the Escompte Gesellschaft, has terminated the year 1903-4 with net profits totalling 161,000 kronen. This sum, together with 307,000 kronen appropriated from the reserve fund, has been devoted to the extinction of the debit balance from the previous year. In addition to the equipment of a number of electricity works and installations, the company delivered during the past year 924 dynamos representing 18 570-H.P. The present financial year opened with orders on hand which amount to about one half of the turnover in the past year.

PERMANENT WAY.

Papers on permanent way construction for tramways are too few, and of the small number which have been printed within the last year or so, not many have been marked either by originality or by a sufficient thoroughness in treatment. That much ignorance of the most suitable practice exists is painfully evident after the shortest rides on many roads which have been constructed for a period which covers only a fraction of the usual estimated life of a rail.

Few consulting engineers have anything but a nodding acquaintance with the elements of successful practical construction; clerks of-works have been trained, as a rule, in the railway school, and borough engineers are competent only to pave the tracks, although they take upon themselves the responsibility of the whole construction from concrete bed to bonding the laid rails.

The consequences are that precedent—"what the other man has done," in other words—has governed, more than anything else, the general outlines, and even the particulars, of tramway permanent way construction; and that depreciation of the rails, paving and bed has proceeded very much faster than the growth of any fund to balance it, to the present consternation of municipal authorities and company directors.

The ignorance of which we have spoken has been unavoidable, one might say, largely because of the absence of reliable data, although concrete beds and girder rails were the rule for some years before electric traction began to supplant steam traction, and the older managers had every opportunity to gather information and to pin down defects all in readiness for the new era. That they did not do so in any notable degree only supplies another argument against the use of such non-engineering minds in matters requiring a wide range of engineering knowledge of a trained and practical variety.

Mr. A. N. Connett has just read a paper before the Tramways and Light Railways Association, which it will repay the three classes of men to whom allusion has been made above to digest thoroughly. It deserves reprinting in full, but for that we have not space. The chief points are sketched below.

Little can be said in the matter of rails now that the Standards Committee has settled the most suitable sections and chemical analyses, but a word of warning is given to those who might use the standard specification without judgement.

There is a wide range of joints offered to the perplexed engineer. All the way from the simple fish-plate to the welded rail, and "all joints are bad, but some are worse than others." The tramway engineer has laboured in the past under the misapprehension that the type of joint which proved successful on railways would be the best for tramways, and even then he did not, and does not now, take the minute precautions in setting up fished joints which are essential to the greatest success attainable with that form of joint. The design of the plates and their very accurate fitting must be attended to in particular, and the joint should be opened up and refixed once a year. "If tramway joints could have the same attention that they have on steam roads the joint problem would have about the same relative importance in the one case as in the other." Considering the final economy to be gained by opening up joints *before* they begin to "work," we are surprised to find that this is practically never done. Mere tightening up of bolts is not enough. The fish-plates themselves should be removed and re-fitted. The cost of doing this is estimated at £30 to £40 per annum per mile of single track where the rails are 60 ft. long. That is a small sum to pay in comparison with the amount which is required for the perpetual and ineffective tinkering which goes on from the fifth to the last year of the prematurely shortened life of the rails on the common alternative system.

Mr. Connett has not much opinion of the scarfed joint, but our experience with this joint has been in its favour, as compared with the plain fish-plated butt joint.

Of the three methods of rail welding, the Thermit is the handiest, as the plant required for making it is so much less than is required in the other cases.

The old dumpy points are being replaced none too soon by points 11 ft. to 13 ft. long, with tongues of manganese steel about 7 ft. long, curved to suit the work. The "tongue and dummy" combination is preferred to the double-tongue arrangement, as point-turners are saved. On some Continental tramways, nevertheless, we have observed double-tongues being worked quite satisfactorily by the motormen by means of point-bars handled from the platform. More uniformity in the matter of points and crossings is desirable.

The presence of a groove makes some wear between rails and wheels unavoidable on sharp curves, but much of this might have been removed by the earlier use of an inclined lip on curves. Concrete construction, although undesirable on several counts, will remain standard in England so long as the tracks are used for other heavy traffic.

Of the two generally accepted ways of setting the rails, that which provides for the completion of concreting in one operation is preferred, and it seems to be in general favour.

The good example of Hull in the matter of maintenance should be quoted widely. Although the oldest joints are giving no trouble (probably owing to careful construction in the first place), they are all being tried with a straight edge, and any showing $\frac{1}{16}$ in. depression on a 5 ft. stretch are being opened out. The cost of maintenance is only ·067d. per car-mile. The rails are of special type, separated from the concrete foundation by longitudinal sleepers.

When laying wood paving, great care must be taken, especially when using hard-wood blocks, to prevent the effects of expansion being injurious.

Bonding, as a subject more thoroughly understood by electrical engineers than the other items of track work, has been more fully discussed, and, perhaps for this reason, Mr. Connett does not deal with it at all.

THE CULT OF THE MARINE ENGINEER: A TIRADE.

[COMMUNICATED.]

So much has of late been written, said, and assumed concerning the super-excellent applicability of marine engineers to central station practice, that it is surely high time for someone to arise and bring upon himself the odium of that numerous and potent class of men, by impugning their entire usefulness in the highly-specialised work of managing the running of a station for the supply of electric light and power. That the following remarks are not impartial is freely admitted; they are an attempt to articulate the mutterings of protest, sometimes couched in unprintable form, emitted from time to time by engineers who have been specially trained for this work, and who see their occupation wrested from them by men whose original ambition lay in an entirely different direction.

Let us carefully examine the career of the marine man before he enters an electric supply station. Starting as an apprentice, he probably spends five years in the shops and shipyards of a marine engineering firm. He learns there a variety of useful items of information concerning one type of engine—the vertical, three or four-cylinder, open, medium speed engine now being to some extent displaced by a prime-mover which first proved its usefulness in electric generating stations. *Apropos* of this, why should not station men now go and teach the marines something? They have had more experience with the steam turbine than the nautical folk. Our apprentice also learns marine-type boiler-making and, perhaps, the general constructional work required in the building of iron ships. His next move is to get to sea. This action is closely followed by reaction, for the aim of nine-tenths of the sea-going fraternity appears to be to cruise about just long enough to get the chief's ticket, and then to clear out as soon as a living wage presents itself on land. While at sea, however, he learns the running of the propelling machinery, consisting of an engine of, say, 5,000 or 6,000 H.P., running at approximately constant load, with as few stoppages as may be; the supervision of stokers whose caste and nationality are of a miscellaneous character; the performance of minor repairs—all heavy work is, if possible, postponed till the ship's arrival in dock, when the company's works staff attends to it; and, if the boat is a passenger steamer, the art of easy and polite conversation with the fair ones, mostly in the popular-lecture-engineering style, which is an excellent training for the display of technical knowledge to a borough council. His youthful ambition prompts him to read for the Board of Trade's second class, and eventually for the chief's certificate—an examination which an average seventh-standard schoolboy could, with a year's special coaching, go through with flying colours.

Now, in all this, what is there that fits a man for central station work? It may be urged that every modern ship carries its electric light plant. Granted—but what plant is it? A low-tension direct-current 1,000-light machine is coupled through a remarkably simple board to a two-conductor system, one pole of which is the ship's hull, and where fault-finding is automatically conducted by the bursting of one or more fuses, or alternatively by the production of a fire of greater or less dimensions. The engineer on watch has to divide his attention between the main propelling engines and this little pigmy. Which is likely to receive his serious consideration? On large boats a more or less skilled electrician is carried, who looks after the wiring, fittings and unofficial complaints. In smaller boats a knowledge of electricity is empirically obtained by the first or second engineer, who thereby becomes a great man. Until two years ago there was no such subject as electricity recognised in the Board of Trade examination for the first-class certificate.

Our marine man—say, third or fourth engineer—now seeks a shore job. The first and second engineers are by now receiving too good a salary to desert the ship. An electric light station wants a fitter, or a junior engineer, or a repairs engineer. Moreover, it wants to save money. The marine man comes along, flourishes his Board of Trade certificate, and after the customary preliminary haggle, is engaged. Now, what is that man doing in a central station at, say, 35s. a week? He is not working with heart and soul, but slipping off at odd minutes to put his nose to within as near sparking distance of the high-tension contacts as he dare, to see how they work; and in due time he gets a rough, approximate, rule-of-thumb, problematic idea of how the electrical gear behaves; and he has waved that Board of Trade certificate with such vigour that Finsbury-trained, Brush Co.-developed men, unused to such fearful brandishments, have quailed at the sight—the natural outcome of which is that he gets a shift engineer's job, and misguided

station superintendents have even been known to advertise, "Marine men preferred!"

What is the secret of this leaning towards the marine pervert? Is it an instinctive respect for the self-trained man? There are plenty of these whose lives have been spent in the electrical sphere—men whose characters are every bit as gritty, and whose knowledge is quite as deep. Is it that the marine man knows the mechanical side, and that the electrical doesn't matter? It needs no elaboration to show that in a central station there are many pieces of mechanical gear which are absolutely new to the man who has just come off his ship, and which can be learnt quite as easily and quickly by an average land engineer. Moreover, the function of a running-engineer is to keep things running; an electrical accident is all over while a mechanical defect is giving notice that it means to cause trouble. At such a time the marine man is in difficulties—he is pondering over his past experience with his 1,000-light machine and his observations on the high-tension contacts, and settling whether he will more certainly get the sack for pulling out all or none of the switches.

A reason, which was expounded to the writer as "plain truth" by a works engineer who made a point of engaging marine men, and whose name shall in mercy be withheld, was as follows:—"The marine man will do anything to stick at home with his wife. He will work like a nigger and take cut-price wages. He won't move to a higher job—he is frightened of it, because he knows condemned well that any theory which is required he hasn't got about him." Be that as it may—and the writer dare not assume responsibility for the statement—there is another and more potent reason. It is that Board of Trade certificate. The electrical man has no little bit of Government paper which he can push in front of the nose of a prospective employer saying, "Behold now, here is unimpeachable proof that I have been in an electrical works as apprentice for so long, that I have held a responsible position, and done my work properly for so long, and that I had a good enough head to pass these Government examinations." The marine man has this document. The employer heaves a sigh of relief when he sees all this information in a nutshell, and—gives the marine man the job.

INCANDESCENT LAMPS ON THE EDISON COMPANIES' CIRCUITS.

By E. KILBURN SCOTT, M.I.E.E., A.M.I.C.E.

About 74 of the principal electric lighting concerns in the States are known as Edison Companies, and although they are not associated in any way financially, they have a close scientific or technical connection. Another concern known as the Electrical Testing Laboratories which tests some 10 million incandescent lamps yearly, is also associated indirectly with the lighting companies.

It may be of interest to English readers to know that the Edison Companies consider it of such vital importance that customers should have a good light, not only pleasing to them, but also a credit to the company supplying current, that they make a practice of giving all the lamp renewals free. About 50 of the companies also supply the original lamps as well, even when it runs to thousands of lamps for a single installation.

The companies only expect a lamp to stay on circuit about 500 hours before the customer sends it in, and they make a rule of exchanging *any lamp*, even though they may know that nothing is wrong with it.

In the case of shops, the value of the advertisement of a good light is so great, that the company actually solicit the shopkeepers to renew their lamps as frequently as possible. They find from experience that money spent in that way creates business by setting up competition between rival shopkeepers.

The bulk of the lamps in use vary from 108 to 124 volts. There are some 220-volt lamps on the Pacific coast, but this pressure has not caught on in America, and apparently everybody is quite satisfied with the lower pressure.

A standard 16-c.p. lamp is required to take 50 watts, and the Testing Co. condemns any lamp which uses 53 watts or over. There is no such thing in the States as a 60-watt 16-c.p. lamp.

The standard of useful life is taken to be a 20 per cent. drop on the initial candle-power. That is to say, when a 16-c.p. lamp gives only 12·8 c.p. its useful life is considered at an end, whatever its condition otherwise.

Here, again, the Edison Companies find it to their advantage to renew the lamps, because independently of the falling off in candle-power, which may displease the customer, there is a falling off in receipts for energy.

Thus in a particular case it was found that a certain 16-c.p. lamp took 3·1 watts per candle, or a total of 49·6 when new. After a time it fell off to 12·8 c.p. and then took 3·7 watts per candle, or a total of 47·3, that is to say, the energy consumption was reduced 4 per cent.

That it pays the Edison Companies to keep a close watch on the condition of their customers' lamps is well shown by the financial success of these companies. Taken over a number of widely separated concerns, the cost of the lamp renewals is found to be less than $\frac{1}{4}$d. per KW.-hour sold, and the maximum is not more than $\frac{1}{3}$d.

VISIT OF THE INSTITUTION OF ELECTRICAL ENGINEERS TO AMERICA.

[BY OUR SPECIAL COMMISSIONER.]

(*Concluded from page* 805.)

The power installations in this city (Washington) were rather disappointing when compared with those seen in other cities, being small and equipped with units of the older belt-driven type, though the Potomac Electric Supply Co. have recently erected a Curtis 2,000-KW. three-phase turbo-generator, and propose bringing their plant up to date by the introduction of three-phase distribution.

All the tramway track within the City limits is operated on the conduit system, in accordance with the terms of the franchise granted to the company by the Legislature. On reaching the outskirts, the cars, which are all fitted with trolleys, stop over a pit in the centre of the track, where the plough is removed by hand and a switch closed so that the overhead wire can be used.

The yokes used in the construction of the conduit also carry the running rails; this type of construction is, of course, much more costly than the method adopted by the London County Council.

The Naval Yard was of special interest, as one of the finest model ship hull testing tanks was being installed there. The models are towed by a high speed electric motor-driven travelling bridge. Prof. Perry, having carefully inspected the apparatus, gave an extempore lecture to the party, emphasising the chief features. In the machine shops an electric motor drive was being installed, the Crocker-Wheeler four-wire multi-voltage system being employed. The motors were applied to the multi-geared lathes in a very ingenious way. The cone pulley was removed, and a special hollow armature shaft made for the motor to run in place of the belt cone pulley. A 10-H.P. motor is also provided for moving the tool carriage on each heavy lathe.

It was interesting to note that wire guns were not being constructed, this type not being the standard of the U.S. Navy, in opposition to the practice of many other countries.

On the same evening after dining together at the New Willard Hotel, automobiles conveyed the party to their special train, which carried them to Philadelphia, arriving at 12 p.m. The night was spent at the Bellevue-Stratford Hotel, one of the new palatial hotels recently erected in America, which had only been opened to the public on that day. A large electric, hydraulic, heating, and refrigerating plant is installed in the basement, the hotel being independent of any outside power supply. This plant was much larger than was anticipated by those who ventured

into the depths to explore, the switchboard with its imposing row of circuit breakers making quite an advertisment for the manufacturer.

A general tour had been arranged for, on the morning of the 21st, by four-in-hand coaches to the following points of interest:—The power house of the Philadelphia Rapid Transit Co., the main generating station of the Philadelphia Electric Co., the Baldwin Locomotive Works, the United States Mint and Independence Hall. A special tour had been planned out for the ladies through some of the principal streets, shopping and financial districts. After a visit of inspection to Independence Hall, they were driven to Fairmount Park, one of the largest in existence, a drive of some miles being taken up the Schuylkill River. This park covers an area of 2,900 acres, and extends some 14 miles in one direction; it must be an invaluable asset for a city like Philadelphia.

At the power house of the Philadelphia Rapid Transit Co. there are installed four 1,500-KW. and two 800-KW. Westinghouse generators, driven by compound condensing engines. A new turbine station was in course of erection, but there was very little to be seen beyond the foundations.

The parties were then driven around the grounds of the University of Pennsylvania, which comprises 33 fine buildings, which are occupied by 3,000 students.

The next visit on the programme was to the main generating station of the Philadelphia Electric Co, one of the Edison companies, which as in other towns has absorbed all the smaller companies. In this station are installed one 5,000-KW., and one 2,000-KW. generating sets. A two-phase 60-cycle distribution was decided upon as the most suitable, under the existing conditions, and the voltage used is 6,000. The station is designed on the sectional plan, so that it can be extended in one direction when required.

The Baldwin Locomotive Works was then visited. In conjunction with the Westinghouse Electric and Manufacturing Co., a large number of electric locomotives are now manufactured here. Some of the American monster railroad engines were seen in various stages of construction. The use of high-speed tool steel has introduced many innovations into this works, in particular it has for the time being caused the milling machines to be displaced in favour of planing machines once more. Electric driving is used throughout, and as an interesting fact in connection with this, it may be mentioned that by doing away with overhead shafting and belting, and by the introduction of electric cranes, the firm estimates that an increase of about 33 per cent. was made in the capacity for work, and the same percentage increase in storage facilities.

The United States Mint was the next item on the programme. A very modern direct-connected motor-driven equipment is installed here. After its inspection, all reassembled at the Bellevue-Stratford Hotel for lunch, when Mr. Weaver (an Englishman), Mayor of Philadelphia, gave a brief address of welcome. After the luncheon, the special Pullman train was boarded for the last time *en route* for New York, which was reached early in the evening.

Seated in the observation car, the operation of the automatic electrically-operated signal system was watched by some of the party with interest. The line the train was travelling over between Philadelphia and New York was a four-track road, owned by the Pennsylvania Railroad Co., over which there is an exceptionally heavy traffic. Every half-mile along the route a signal is placed and so arranged that trains on the same track cannot approach nearer than one mile from each other. The schedule is so close that often only this minimum distance remains between the trains, a distance which seems rather close when trains are travelling in the neighbourhood of 50 miles an hour.

On Thursday afternoon, September 22nd, automobiles were waiting for the visitors at the Waldorf Hotel to convey them to the River Ferry, by aid of which they joined a special train for West Orange, New Jersey, where the Edison laboratories and factories are situated. Before commencing the tour of inspection all the members of the party were personally introduced to Mr. Edison. At the end of the introductions a phonograph played the British National Anthem, which little courtesy was much appreciated by the visitors. Groups were then formed to facilitate the tour of inspection; one party being personally conducted by Mr. Edison.

It is the proud boast of the laboratory that it has samples in its store rooms of nearly every chemical in existence.

The phonograph factory, which was then viewed, was a good type of an up-to-date American speciality factory. In addition to phonographs, other products were records, cinematographs, and numbering machines. The process of making the wax records and of dealing with the saphire stylus for the recording and reproducing diaphragm was of special interest, the latter work being nearly all done under the microscope.

Afternoon tea was served in the library, and then a short exhibition of cinematograph pictures took place. Undoubtedly, to see the cinematograph and hear the phonograph at their best, a visit must be paid to this factory, for the exhibition given here was finer than any of the party had seen before.

In the evening the members of the British Institution of Electrical Engineers gave a farewell supper to the New York Committee of the American Institute of Electrical Engineers and those representatives of the committees of other cities who were able to attend, about 100 being present.

Mr. Gray referred to the success of their visit and to the great kindness and hospitality they had received everywhere they had been. Col. Crompton returned thanks, on behalf of the party, to the manufacturers and others who had so liberally thrown open their works for inspection. Responses were made by Mr. Bion J. Arnold, President of the American Institute, Mr. C. L. Edgar, chairman of the Boston Local Reception Committee, Mr. S. Insull, chairman of the Chicago Committee; Mr. T. C. Martin, chairman of the New York Committee; and Mr. E. H. Mullin, chairman of the Transportation Committee.

After the supper an informal presentation took place, souvenirs being given by the party to Mr. and Mrs. E. H. Mullin, Mr. R. W. Pope, secretary of the American Institute, and Mr. T. C. Martin, chairman of the New York Reception Committee, all of whom had worked especially hard to ensure the comfort of the party being maintained at a high standard. On Friday, the 23rd, a visit was arranged in the morning to the Crocker-Wheeler works at Ampere.

In the afternoon about half the party, including Prof. Perry, Dr. Glazebrook, Prof. Cormack, Mr. Lloyd, and others sailed in the White Star liner ss. *Arabic*, for Liverpool, amidst the cheers of their New York hosts, who had come down to the quay to see them off, and the remainder of their *confrères*, who had made arrangements to return a week or so later, not yet being satiated with visits to works and power installations.

Thus ended a most enjoyable visit, in which a great deal of ground had been covered, and a good deal that was new and interesting seen, and learnt, of and about a new country. Things were noticed that in some cases could not be carried out in an old country, and in other instances features that could not be adopted in America on account of the lack of the conditions that exist in a more densely populated land were conspicuous by their absence.

A special feature in many of the large towns is the electric lighting combinations, miniature trusts, which had absorbed all the smaller companies, chiefly under the control of the Edison Illuminating Co., and the General Electric Co. New and enormous stations with large units taking the place of the smaller plants, and incidentally reducing the cost of production to a minimum.

In his speech at the farewell supper, held on September 22nd, Mr. S. Insull, of Chicago, urged that the electric supply business in the large cities of England should be carried out as in America. As an example, he pointed out that London had no fewer than sixty-three separate generating stations, which was undoubtedly a great mistake. He knew that legislators and financiers were opposed to this at present, but it was the duty of the engineer to educate them with respect to these matters, for if this lesson were learned it would greatly alter the conditions of electric supply to the advantage of England.

The rates charged to private consumers in America, notwithstanding this combination and cheapening of production, seemed to be higher than in England; on the other hand, the charge to power consumers on a large scale is extremely

low. The system of charging private consumers is a very complicated one, as a variety of different methods are in use in each city.

Power is sold at so much per horse-power per annum, a unit that is not familiar to engineers in this country. The rate varies from $15 to $30 (say £3 to £6), a rate which compares favourably with other sources of supply.

The limit of size of the reciprocating steam generator appears to be 5,500 KW. Turbo-generators are being constructed and in use up to 10,500 KW., and undoubtedly this type of generator has come to stay. The factories where they are constructed are extremely busy with orders for this class of work, though otherwise, very few of the works in America seem to be working at anything like their full capacity, the Presidential election and other causes leading to a depression in the market at present. The Presidential election certainly seems to be a most disturbing factor, occurring as it does every four years, and results in a most serious dislocation of trade, far more serious than any Parliamentary election in England.

The Babcock & Wilcox type of boiler, with Roney stokers, seems to be almost universally used for power station work. Economisers are rarely used, though a space is usually left to fit them in. The very cheapest fuel obtainable is consumed.

A feature of all the newer power stations was the almost complete control of the plant from the switchboard, which in itself was of the diagram type, having mounted on it only the instruments and small control switches or presses which controlled the main electrically-operated switches. The highest alternating current pressure on the switchboard panels, did not often exceed 115 volts, derived from potential transformers. The field rheostats, the main engine governors, the main and feeder switches, the main steam stop valves, &c., were generally motor operated, usually being placed out of sight of the switch gallery, tell-tale coloured lamps and indicators informing the switchboard attendant as to whether they were open or closed. Batteries seem to be very little used, probably due to the very large size of the average power station, where there would be no capital saving by their introduction. It is generally admitted though, that they would be advantageous in sub-stations.

All the power and light distribution outside the actual business centres of the cities is carried out by the aid of overhead cables. Transformers are mounted on the top of the posts, at points where energy is required for local use. This overhead construction is very unsightly, and little care seems to be exercised in choosing straight poles, which does not add to the neatness.

The construction of the streets was deemed very poor, and the tramway tracks were decidedly bad. The overhead construction was often of a very flimsy character. It was not at all unusual to see a feeder being used as a span wire and thus serving a double duty. The use of wooden posts undoubtedly does away with the necessity of having good insulators, which is an economy. One trolley line used on constructional work at Niagara Falls, was attached to the wooden cross-arms of the posts, by the simple method of twisting a piece of wire around both, the only insulation being that due to the post itself. This, of course, was an extreme case.

The high speed at which the trolley cars are operated, must be seen to be appreciated; 30 miles an hour is often attained in the cities, and 40 to 70 in the country. The almost universal adoption of air-brakes, however, means that the cars are well under control. It would seem that the introduction of air-brakes into England would be of great advantage, more especially on the heavier cars, for it is a successful power brake that is entirely independent of the car motors The use of such a brake also ensures that the brake-blocks are not kept in a position where they just rub on the wheels, as is so often done by drivers in England, when using a hand-brake, so as to enable them quickly to apply the brake when necessary, regardless of the power they are wasting.

The curves on the double track, when turning a street corner, were nearly always too close to each other, with the result that two cars could not pass each other without colliding. The straight-running trolley head is in use almost without exception.

Horse and cable-drawn cars are still in use, for special reasons, in New York and Chicago, and many of the tramway concerns are in a far from flourishing condition, the dividends, if any, being very low.

To English minds the railway level crossings seemed very unprotected and dangerous.

The practice throughout the country seems to be to let each man look out for danger for himself. there, apparently, being no grandmotherly, or otherwise, Board of Trade to look after him.

The single-phase railway problem is one that is absorbing a great deal of attention at present, and good results are being obtained; already one commercial road is equipped and another is in course of equipment.

It was very noticeable, how complete a control of the electrical business, the two large electrical manufacturing concerns in the United States have, other firms not seeming to have the opportunities they would get in England for introducing their manufactures.

Disappointment was expressed at many of the machine shops, for though there are some very fine shops in America, there are also others which could learn many lessons from England. Perhaps the most striking feature was the radical change in practice that has been brought about by the use of high speed steel. No process discovered in recent years has effected such an increase of manufacturing capacity and such a general revolution in machine design. Incidentally it has caused a temporary difficulty in setting piecework prices.

It was very striking to note how comparatively young the leaders in American engineering enterprises are; most of them have made their names before leaving the thirties behind, and are consequently men with a long future before them.

The courtesy of the Americans to the visitors was very open-handed and generous, nothing being too much trouble for them to undertake in the way of entertainment or instruction. This was much appreciated by the visiting party, as it enabled them to see much in a short time, with a minimum of fatigue, and all carried away with them a very pleasant recollection of American energy, enterprise, and hospitality, as evidenced by the electrical engineering section of the community.

TRAMWAY BRAKES.

The *Electrical World and Engineer* Digest of September 17th contained a report presented at the Vienna meeting of the International Street Railway and Interurban Railway Association, by Herr Scholtes, on brakes for electric street railways, based on information received from 54 companies, and on a former report by Poetz, which covered the practice of 20 companies. Scholtes distinguishes the following three groups:—In the first group hand-brakes, operated by the motorman, are used, and only in special cases are short-circuit brakes applied; this method is used in 63 per cent. of all companies which replied to the inquiries. The author calls attention to the hand-brake used by the Leipsig Street Railway. In the same a sufficient braking effect is obtained by a friction device between brake gear and brake crank, without any exertion of the motorman, since the momentum of inertia of the car is utilised for pressing the brake shoes against the wheels. This brake is stated to have proved very satisfactory. Besides the hand-brake, most of the companies in this group use the electric short-circuit brake as an emergency brake. The second group comprises those companies which use in general, electric brakes, together with hand-brakes. This is done by 22 per cent. of the companies. In this case the trailers are also generally braked electrically. The author seems to be rather favourably inclined toward the electric brake. The motors should be chosen of sufficient capacity to prevent undue heating. On grades the cars must be stopped by means of the hand-brake. The third group comprises air-brakes, and is sub-divided by the author into two classes. One class comprises four companies which have air-brakes on all motor cars, the other six companies which use air brakes on only a portion of their cars, only the heavy trains and cars being provided with the same. The author has made careful measurements of the power required for operating the air pump; the energy consumption with electric braking and without the air brakes was 429 watt-hours per km., with the air brakes 456 watt-hours per km., so that the difference of 27 watt-hours = 6·3 per cent. was the energy consumed by the pump. The statements of the different companies as to cost of operation and maintenance are scarce, and vary greatly, the average values being as follows:—Hand brakes, 0·06 cent per car-km.; electric brake, 0·02 cent. per car-km.; air brake, 0·08 cent per car-km., so that the air brake is the most expensive one. The

general conclusions of the author are that the load conditions are to be taken into account. The brakes should not cause any jerking. There should always be two independent brakes. The main brake must not tire the motorman out. If the hand brake is insufficient as a main brake on account of too great a weight, or too great a number of trailers, or too difficult conditions of the track, a mechanical type of brake should be used, and the electric brake should be introduced. Under special conditions (for instance, if the motors have not a sufficient capacity, or if the controllers and rheostats have not enough steps) air brakes may be used to advantage. For heavy loads, high speeds, and with more than two trailers, air brakes should always be used.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

23,425. "Improvements in live rail protections for electric railways." J. Linkleter. October 31st.

23,438. "Improvements in magneto-electric apparatus for ignition purposes in connection with internal combustion engines." H. C. L. Holden. October 31st.

23,459. "Improvements relating to the insulation of coils of electrical apparatus." O. B. Moore. (Date applied for under Patents Act, 1901, November 21st, 1903, being date of application in United States.) October 31st. (Complete.)

23,461. "Improved portable electric alarm." R. F. Rowe and W. R. Bloye. October 31st.

23,525. "Improvements in connection with electrical radiators." H. J. Dowsing. November 1st.

23,527. "Improvements in or relating to electric cable conductors." W. E. Hitch. November 1st.

23,559. "An appliance for divergirg electric currents from a main line or for connecting cables or wires." E. Garsin. (G. Bogni.) November 1st.

23,565. "Motors for washing machines." G. E. Averill. November 1st. (Complete.)

23,567. "Improvements in and relating to electric incandescent lamps." A. W. Hill and J. Harrington. November 1st.

23,579. "Improvements in or relating to driving belts and the like for preventing electrification of the same." L. Lelout, R. Obernesser, J. Tenthorey and V. Tenthorey. November 1st.

23,604. "Improvements in or relating to electric incandescent lamps." F. Riethof and A. Basch. November 1st. (Complete.)

23,612. "Improvements in enclosed dynamo-electric machines." R. M. Newbold. November 1st. (Date applied for under Patents Act, 1901, November 3rd, 1903, being date of application in United States.) (Complete.)

23,622. "Improvements in galvanic batteries." P. Mollmann. November 1st. (Complete.)

23,661. "Improvements in dynamo-electric machinery." S. T. Webster. November 2nd.

23,685. "Improvements in electric projecting lamps, chiefly for enlarging and projecting lanterns." L. Kamm. November 2nd.

23,696. "Improvements relating to electric cables or conductors applicable for submarine use." J. A. L. Dearlove. November 2nd.

23,716. "Improvements in devices for preventing sparking of the commutators of electric motors." Allgemeine Electricitats Gesellschaft. November 2nd. (Date applied for under Patents Act, 1901, November 2nd, 1903, being date of application in Germany.) (Complete.)

23,726. "Improvements in or relating to rheostats." C. Wirt. (Date applied for under Patents Act, 1901, November 6th, 1903, being date of application in United States.) November 2nd. (Complete.)

23,765. "Improved insulating material for electro-technical purposes." A. Rudenick. November 3rd.

23,769. "Improvements in electro-magnets for extracting magnetic impurities from liquefied materials." H. W. Wilson and The East Anglian Engineering Co., Ltd. November 3rd.

23,797. "Improvements in temperature compensating devices for electrical recording instruments." W. H. Bristol. November 3rd.

23,808. "Improved construction of push button switch." A. C. Burnett and J. Richmond. November 3rd.

23,811. "Improved manufacture of plates and electrodes for electric accumulators and storage batteries." G. Schauli and G. Petrides. November 3rd.

23,816. "Improvements in electric control systems." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) November 3rd.

23,817. "Improvements in electric motor control." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) November 3rd.

23,820. "Improvements in and relating to electrical choke coils." G. S. Carson. (Date applied for under Patents Act, 1901, March 30th, 1904, being date of application in United States.) November 3rd. (Complete.)

23,828. "Improved terminal for electrical apparatus." H. G. Prested. November 3rd. (Complete.)

23,871. "An electrical buoy light." P. Watson. November 4th.

23,885. "Improvements in magnetic brakes for railway and other vehicles." R. Brain. November 4th.

23,899. "Improvements relating to the manufacture of incandescent electric lamps." A. Just and F. Hanaman. November 4th.

23,923. "Improvements in incandescent electric lamps, and in the method of exhausting the same." A. W. Kenyon. November 5th.

23,952. "Improvements in and connected with telegraphic and other transmitting apparatus." J. T. Armstrong and A. Orling. November 5th.

23,960. "New illuminators applicable to electric or other theatrical stage sights, or for forming electric or other letters, signs or the like illuminative displays." W. Goulton. November 5th.

23,969. "Improved construction of electric arc lamp." H. Diamant and A. Chiesa. November 5th.

23,971. "A new or improved electric device adapted for circuit closing, indicating power transmitting, and possibly other purposes." G. L. Anders and M. Bing. November 5th.

23,972. "Improvements in electrical indicating or measuring instruments having springs to convey the current to a movable system." Siemens Bros. and Co., Ltd. (Siemens & Halske, Akt. Ges.) November 5th. (Complete.)

PATENTS EXPIRING DURING 1904.

(*Concluded from page 813.*)

18,186. "Improvements in electrical measuring instruments." H. H. Lake. (E. Weston.) November 11th, 1890. Relates to meters of the electro-dynamometer type for measuring current strength or electromotive force. A fixed coil is arranged in series or in shunt with a movable coil, the pivots of which are fitted with spiral springs. The upper pivot carries a disk, to which is attached a pointer. To prevent violent contact of the pointer with the stops and avoid oscillation, pins projecting from a disk engage with arch-shaped slots in curved pieces carried by an arm, which has a vertical pin movable in a curved slot; when the coil is deflected, the movement of the pointer is limited by the curved slots, the arm being then moved in the same direction as the pointer until the slots are in advance of the pins and the pointer takes up its final position. For retarding the motion of the pointer, so as to make the instrument "dead beat," a friction brake is used consisting of a disk against which bears a pad; when a pin is pushed slightly downwards, the circuit is completed through the springs, a further depression of the pin first diminishing the pressure of the pad on the disk to permit of the turning of the latter, and then entirely releasing the disk. For correcting for temperature variations, a series of resistance coils are arranged in the meter circuit and so marked that a movable contact arm can be moved into the required position to keep the resistance constant after inspection of an attached thermometer.

18,625. "Improvements in and relating to apparatus for use in electric welding, forging, and other metal working operations." H. H. Lake. (H. Lemp.) November 18th, 1890. In apparatus for welding, forging, &c., by electricity, several transformers to supply the electric heating current to the work or work holding devices are used arranged in parallel or multiple arc. Means are provided for regulating the current supplied to the different parts of the work. In the arrangement described, the primary circuits connected to an alternating-current generator, are situated in channels in the secondary bars. Separate cores or a single core may be used for all the transformers. One or more bridge-pieces may be used in the core. Shunts with variable resistances may be provided in each primary circuit for regulating the current. A regulating device consisting of an iron ring or core on which are two coils may be used. On moving a copper circle or band closer to one or other of the coils, the current in the primary circuits is varied. The tops of the secondary bars are bevelled to receive the clamp made in two parts insulated from one another. The two transformers may be arranged at an angle to one another, and the clamp or work-holder may work in the angular bearing between the secondary bars. The transformers may be arranged round the sides insulated from one another, and the work-holding jaws are forced up by pressure cylinders or screws, &c.

18,576. "Improvements in apparatus for controlling electric currents." R. H. C. Neville. November 18th, 1890. Relates to apparatus to allow a current of electricity to flow in one direction only, through a circuit, or through a very high resistance in the reverse direction.

18,596. "Improvements in the process and apparatus for manufacturing copper tubes, sheets, strips, and wires by electrolysis." A. S. Elmore. November 21st, 1890. Metal pipes and tubes are formed by electro-deposition on a mandrel, and are removed by being expanded. The tubes may be cut into sheets or spirally into strips to be drawn into wire. In the specification a cross-section of one of the plating-baths is shown and described. The baths are arranged in two parallel rows, and the mandrels are mounted on wooden axes which rest in glass bearings, contact with the generator being made by means of brushes. The copper anode consists of a horizontal perforated copper plate covered with granulated copper. Vertical copper plates are arranged each side of the mandrel. The mandrels are driven by chain and belt gearing from a central shaft. A burnisher travels to and fro along a screw shaft, the motion of which is reversed by means of a clutch automatically actuated by stops on a sliding rod linked to the clutch lever. The burnisher tool is mounted in a slotted arm, and has an elastic band for regulating the tension. The layers of copper are rendered detachable by oxidising the surfaces of each layer, or each layer may be varnished with wax. The method of expanding the tubes for removal from the mandrel is described. The mandrel holding the tube is supported in end bearings, and can be rotated whilst a stand carrying the adjustable rollers is moved lengthwise by means of a screw.

19,076. "Improvements in electric safety fuses." W. M. Mordey. November 24th, 1890. The conductor preferably of thin copper wire or foil is embedded in or surrounded by pulverised non-conducting material, such as chalk, marble, brick, sand, &c., which absorbs the metal when volatilised. For strong currents this fuse is preferably used as a shunt with an ordinary cut-out which acts first, the current being finally cut out by the fine fuse.

19,740. "Improvements in column printing telegraph receivers." F. H. W. Higgins. December 3rd, 1890. In a column printing telegraph receiver apparatus is described for bringing the type wheel to the beginning of a line when the apparatus is in a pre-determined position and for feeding the paper at the same time. A spring is also provided which is wound up by the motion of the type wheel, which is unwound when the type wheel is returned to its initial position.

20,425. "Improvements in the regulation of the speed and power of alternating current motors." M. von D. Dobrowolsky and Allgemeine Electricitats Gesellschaft. December 15th, 1890. Relates to motors driven by a number of alternating currents in different phases which produce in the field magnet a series of revolving poles. For the purpose of regulating the speed and power of such a motor the armature is wound with coils which are placed in circuit with adjustable resistances.

350. "Improvements in the formation of electrodes for use in primary and secondary electric batteries." L. Epstein. January 8th, 1890. Plates or electrodes for secondary batteries or for primary batteries with a negative electrode of lead dioxide are made by boiling lead plates, &c., of suitable shape in water containing nitric acid or other corroding agent. A firmly adherent deposit is thus produced. These plates are placed as negative electrodes in a tank containing sulphuric acid, &c., the positives being formed of untreated lead plates or already converted plates. Positive plates are thus produced; it is advantageous to oxidise and di-oxidise each plate more than once. Various forms of corrugated ribbed or indented plates may be used. One electrode is preferably made in box form, completely enclosing the other with insulators and separators. The inner surface only of the electrode is made active.

1,110. "An improvement in galvanic batteries." C. A. Hitchcock. (W. Burnley.) January 21st, 1890. A zinc cylinder is lined with a semi-liquid or plastic substance containing the exciting substance; a mixture of sal-ammoniac zinc chloride and plaster of paris may be used. Within this is a second layer enclosing a carbon, and having a similar composition, but containing depolarising material such as peroxide of manganese charcoal. The battery is sealed by bituminous materials.

French Duty on Meters.—According to a recent tariff revision, voltmeters, ammeters, wattmeters and ohmmeters are subject to duty as inductors of dynamo-electric machinery on the following basis of weight:—Exceeding 2,000 kg., 35 fr. per 100 kg.; from 1,000 kg. to 2,000 kg., 40 fr.; from 200 kg. to 1,000 kg., 45 fr.; from 1 kg. to 200 kg, 60 fr.; and less than 1 kg., at the rate of 75 fr. per 100 kg.